Volume 21 Study G-I-S

STATE OF ALASKA

Jay S. Hammond, Governor

Annual Performance Report for

COLLECTION AND INTERPRETATION OF INFORMATION NEEDED TO SOLVE SPECIAL MANAGEMENT PROBLEMS

by

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RESEARCH PROJECT SEGMENT

State:	ALASKA	Name:	Sport Fish Investigations of Alaska
Project No.:	F-9-12		
Study No.:	G-I	Study Title:	INVENTORY AND CATALOGING
Job No.:	G-I-S	Job Title:	Collection and Interpretation of Information Needed to Solve Special Management Problems

Period Covered: July 1, 1979 to June 30, 1980

ABSTRACT

Due to the specialized nature of the investigations being carried on under Job No. G-I-S, a separate section is devoted to each of the job objectives. An index map of 1979 Inventory and Cataloging operations in southeast Alaska appears in Figure 1.

Section I

The Inventory and Catalog filing system was revised this year to increase ease of information retrieval. Both the Juneau and Sitka files were organized numerically to match the anadromous stream numbers.

Information on lakes was more difficult to file in as simple a manner. The first five digits of the stream numbers were used as filing units. All lakes lying in a statistical subarea (i.e., 113-81) are filed in a numbered unit. Each lake in a given unit has its own file folder and is identified by proper name or latitude-longitude coordinates.

Section II

The limnology and fish populations of Swan and Lost Lakes and their inlet streams were investigated to evaluate the effect of hydroelectric development at Swan Lake. Dolly Varden, *Salvelinus malma* (Walbaum), and kokanee, *Oncorhynchus nerka* (Walbaum), were found to be the only species in each lake. These populations will be influenced as follows: (1) the inlet to Swan Lake below the partial barrier will be flooded and (2) the increased water level will allow interchange between the Swan Lake and Lost Lake fish populations. This will reduce total spawning and rearing area in the lower river but allow fish from Swan Lake to spawn in the inlet to Lost Lake if water level in the reservoir is high at time of spawning.

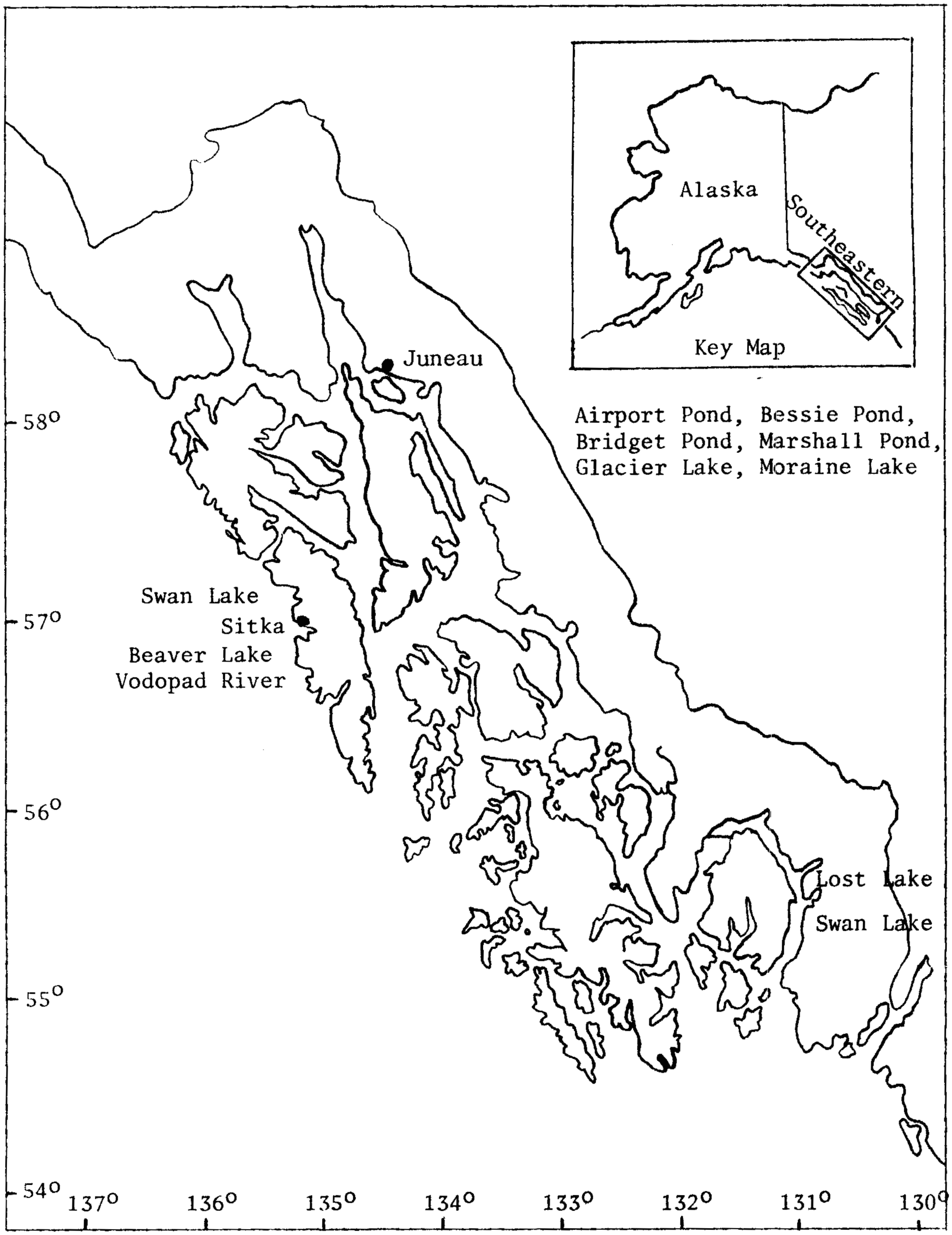

Fig. 1. Index map of Inventory and Cataloging operations, Southeast Alaska, 1979.

Section III

The spawning and rearing potential of the Vodopad River was evaluated to determine what will remain after Green Lake impoundment for hydroelectric power. The only prime spawning and rearing area is in the lower river valley. This area will be permanently under water once the dam is completed and the reservoir filled. The prime spawning and rearing area of the Vodopad River will therefore be lost. The stream area which may be exposed during reservoir drawdown was mapped. The upper section of the mapped area has very little spawning potential or rearing area. The lower section which would be exposed only during major reservoir drawdown has moderate spawning potential and rearing area.

Section IV

The potential productivity of several small lakes along the Juneau and Sitka road systems was evaluated to determine feasibility of establishing put-and-take fisheries in each. Management recommendations were made for each system.

SECTION I

OBJECTIVE

1. To continue collection, analysis and organization of all available and new information on sport fish resources of individual lakes, streams and saltwater areas in southeast Alaska.

BACKGROUND

The Inventory and Catalog File was created to provide a library for the collection of reports of management actions, research data, development plans, and other information of interest for each aquatic system in southeast Alaska. This file is maintained in duplicate in Juneau and Sitka Department of Fish and Game offices. It was organized in 1972 (Schmidt and Robards, 1973) to facilitate the dissemination of information to resource agency personnel and the interested public.

RECOMMENDATIONS

1. Collection and analysis of all available information on sport fish resources in southeast Alaska should be continued. All information should be filed in duplicate files in Juneau and Sitka offices.

2. Field office files in Ketchikan and Petersburg should be updated and revised to the new system established this year.

TECHNIQUES USED

The Inventory and Catalog filing system was revised this year to increase ease of information retrieval. Both the Juneau and Sitka files were organized numerically to match the numbers taken from the Catalog of Waters Important for Spawning and Migration of Anadromous Fishes (Catalog, 1975).

The eight-digit numbers assigned by the Alaska Department of Fish and Game is comprised as follows: (1) the first series of three numbers is the major statistical area in which the stream lies; (2) the second series of two numbers is the statistical subarea within the larger area; and (3) the last three-digit number is that of the individual stream.

Available information on each stream in southeast Alaska was filed with the proper Anadromous Fish Catalog number. Numbered files were organized from the smallest to the largest number. Several streams not listed in the Anadromous Stream Catalog were each assigned an eight-digit number similar to the official numbers, but followed with the letter "U" to indicate an unofficial status, i.e., not recognized by Alaska Statute 16.05.870.

The stream identification numbers used in the file were all printed on U.S. Geological Survey topographic maps. These maps are kept with the files for ease in locating the proper filing number of any desired stream. A Rolodex file was also established to cross reference proper names and stream identification numbers. This is kept with the Juneau Inventory and Catalog File.

Information on lakes was more difficult to file in as simple a manner. The first five digits of the stream numbers were used as filing units. All lakes lying in a statistical subarea (i.e., 113-81) are filed in a numbered unit. Each lake in a given unit has its own file folder and is identified by proper name or latitude-longitude coordinates.

After the revision of the filing system was completed, one month was spent searching for and filing new information. The process was then suspended for the year due to lack of funds.

SECTION II

OBJECTIVE

2. To determine fishery and recreation potential of the main inlet to Swan Lake, Revillagigedo Island, upon completion of dam for hydroelectric power.

BACKGROUND

Limnology and fishery investigations were conducted on Swan Lake in 1977 when it was first considered for hydroelectric development (Schmidt, 1977).

The reader is referred to the 1977 report for a limnological analysis of Swan Lake.

The present study devoted 2 weeks of field work to further evaluate Swan Lake, the main inlet stream, and Lost Lake, as they would be effected by raising of the water level in Swan Lake. No previous information is available on the fishery or limnology of Lost Lake.

A listing of common and scientific names of fish species referred to is included in Table 1.

RECOMMENDATIONS

The Dolly Varden and kokanee populations existing in Swan and Lost Lakes will probably be influenced by the proposed hydroelectric development because: (1) the inlet to Swan Lake below the partial barrier will be flooded; and (2) the increased water level will allow interchange between the Swan Lake and Lost Lake fish populations. This will reduce total spawning and rearing area in the lower river but allow fish from Swan Lake to spawn in the inlet to Lost Lake if water level in the reservoir is high at time of spawning.

TECHNIQUES USED

Limnological investigations were conducted on Swan and Lost lakes during the weeks of June 27 and August 6.

A bathymetric map was prepared for Lost Lake. A recording fathometer was used to record depth contours on transects crossing each lake. The depth contours were transferred to bathymetric maps, and morphometric data were calculated from these maps.

Sampling stations were established at approximately the deepest portion of each lake. Vertical profiles of temperature and specific conductance were recorded at each station. Field chemical analyses, including alkalinity titrations, were conducted according to Standard Methods (1971).

Zooplankton were collected by making duplicate vertical tows from 30 m on Lost Lake and 100 m on Swan Lake. Nets used were 0.5 m diameter and 3 m long. Straining cloth of the net had aperture of 153 microns and 45% open area. Plankton were identified and counted. Efficiency of nets was not accounted for in calculations. Thermal profiles and Secchi disc readings were taken in conjunction with plankton tows.

Stream drift organisms were collected by placing two nets in the main outlet from each lake. Nets used were 12 inches square, 3 feet long, made with Nitex with pore size of 280 microns, and 45% open area. Benthos were preserved for future identification and enumeration.

Bottom fauna were collected by dredging with an Ekman 6-inch dredge. Bottom samples were washed through three screens, the finest having 28 meshes per inch. Organisms were preserved in 70% ethyl alcohol.

Table 1. List of common and scientific names and their abbreviations.

Common Name	Scientific Name and Author	Abbreviation
Dolly Varden	*Salvelinus malma* (Walbaum)	DV
Kokanee	*Oncorhynchus nerka* (Walbaum)	
Brook trout	*Salvelinus fontinalis* (Mitchell)	BT
Pink salmon	*Oncorhynchus gorbuscha* (Walbaum)	PS
Arctic grayling	*Thymallus arcticus* (Pallas)	GR
Cutthroat trout	*Salmo clarki* Richardson	CT
Coho salmon	*Oncorhynchus kisutch* (Walbaum)	SS
Threespine stickleback	*Gasterosteus aculeatus* Linnaeus	TST
Rainbow trout	*Salmo gairdneri* Richardson	RT
Flounder	*Pleuranectidae* spp.	
Prickly sculpin	*Cottus asper* Richardson	PSC
Coastrange sculpin	*Cottus aleuticus* Gilbert	CSC

Age, growth, and food habits of fish in the lakes were determined from fish collected throughout the study period.

FINDINGS

Morphometry

The depth, size, and shape of lakes strongly influence physical and chemical conditions which prevail in them. Since physical and chemical parameters limit species composition and abundance of organisms, it is essential to study the morphometric features of lakes. A bathymetric map of Lost Lake (Fig. 2) was prepared from sounding data. Morphometric data for Lost Lake is presented in Table 2. Mean depth of Lost Lake is 14.8 m.

The main inlet to Lost Lake and the outlet from Lost Lake to Swan Lake were surveyed and sketches prepared showing stream bottom type, pools, obstructions, and general configuration. The main inlet to Lost Lake is shown in Fig. 3. The inlet to Swan Lake is shown in Fig. 4. Both of these streams have good spawning and rearing areas with undercut banks and rubble-coarse gravel substrate. Many of the pools are sand filled.

The only partial barrier between the lakes is a small falls halfway from Swan to Lost Lakes (Fig. 5). This is not thought to be a complete fish block now, as the same fish species occupy both lakes. When the proposed reservoir reaches high water level, this falls and the river below will be under water. This condition will allow easier upstream movement during high water periods but will probably not exist during kokanee spawning.

Physical and Chemical Considerations

Observations of temperature, Secchi disc, visibility, pH, conductivity and alkalinity were made on each lake during the survey. Sampling stations for Lost and Swan Lakes are shown in Figs. 6 and 7, respectively.

Secchi disc visibility of both Lost and Swan Lakes was good at 8 m and 9 m, respectively. A thermal profile of Swan Lake is shown in Fig. 8. Water quality analysis of both lakes (Table 3) shows low conductivity and low mineral content.

Plankton

Zooplankton were collected only once from Lost and Swan Lakes (Table 4).

Fish

Resident fish were sampled by gill net and fry traps. Catch data are summarized in Table 5. Condition factors of Dolly Varden and kokanee in Lost Lake were much higher than those in Swan Lake (Table 6). Length-weight relationships of Dolly Varden from Lost and Swan Lakes are shown in Fig. 9.

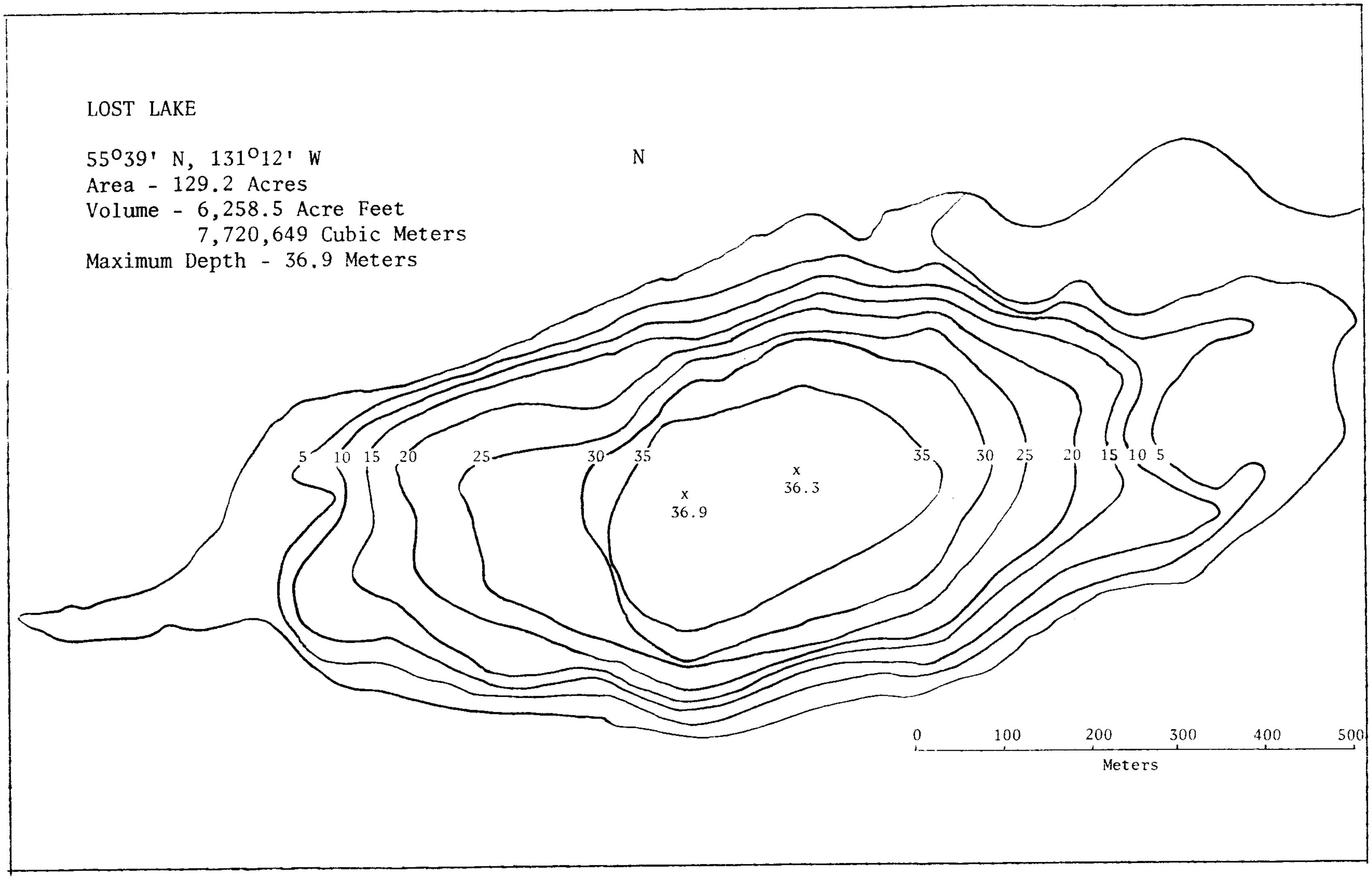

Fig. 2. Bathymetric map of Lost Lake.

Table 2. Morphometry of Lost Lake.

Water Area 52.3 ha or 129.2 acres

Area by Depth Zone

Depth Zone (m)	Area (m^2)	Percent of Total Area
0- 5	124,876	23.9
5-10	56,627	10.8
10-15	52,671	10.1
15-20	55,638	10.6
20-25	62,067	11.9
25-30	57,616	11.0
30-35	45,499	8.7
35+	68,249	13.0

Water Volume

Cubic Meters 7,720,649

Acre Feet 6,258.5

Volume by Depth Zone

Depth Zone (m)	Volume (m^3)	Percent of Total Volume
0- 5	1,068,131	13.8
5-10	1,848,464	23.9
10-15	1,575,192	20.4
15-20	1,007,746	13.1
20-25	1,008,004	13.1
25-30	707,882	9.2
30-35	450,179	5.8
35-36.9	55,050	0.7

Maximum Depth = 36.9 m   Mean Depth = 14.8 m

Shoreline Length = 3,655.4 m   Shoreline Development = 1.4

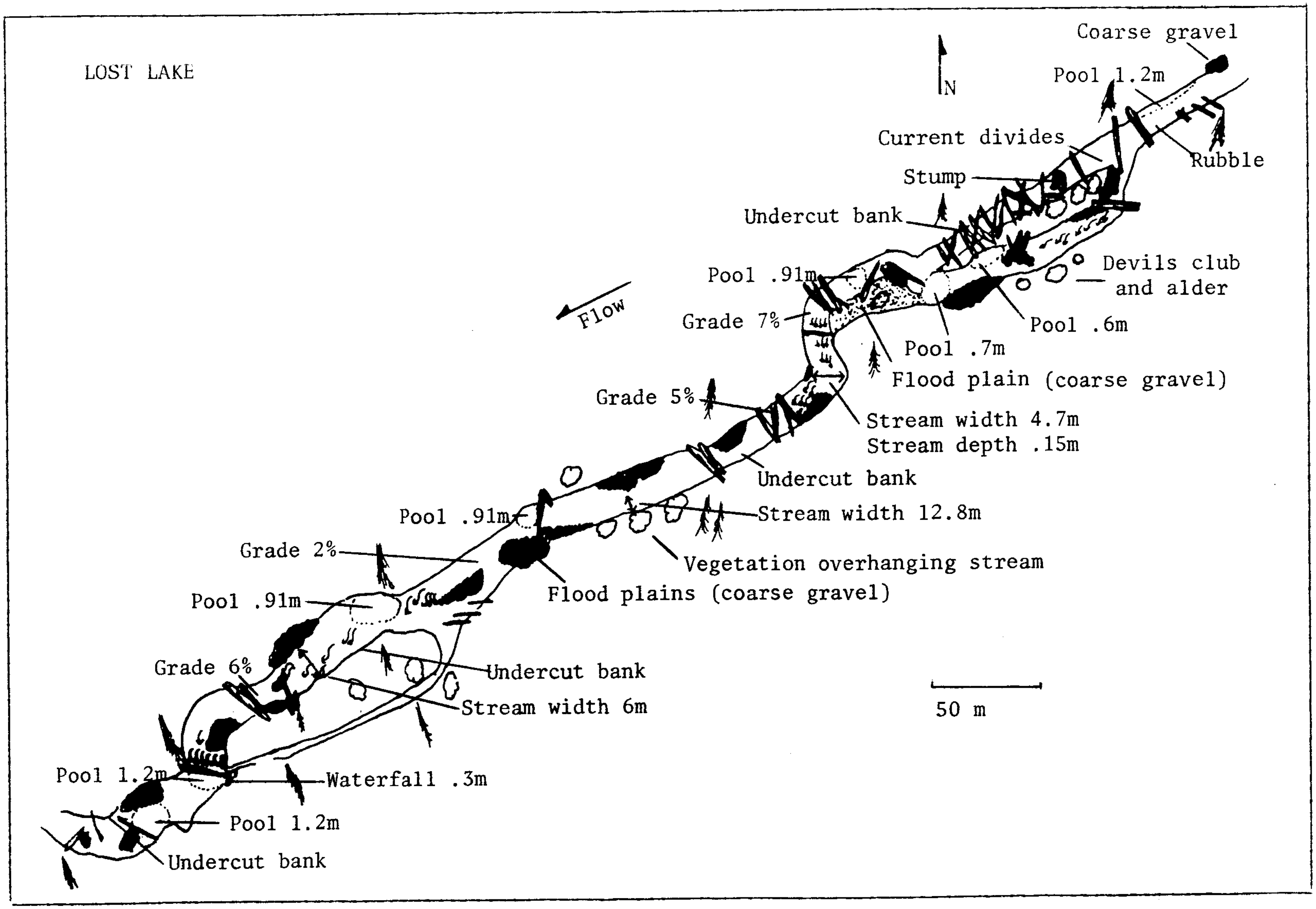

Fig. 3. Map showing main inlet (upper section) to Lost Lake.

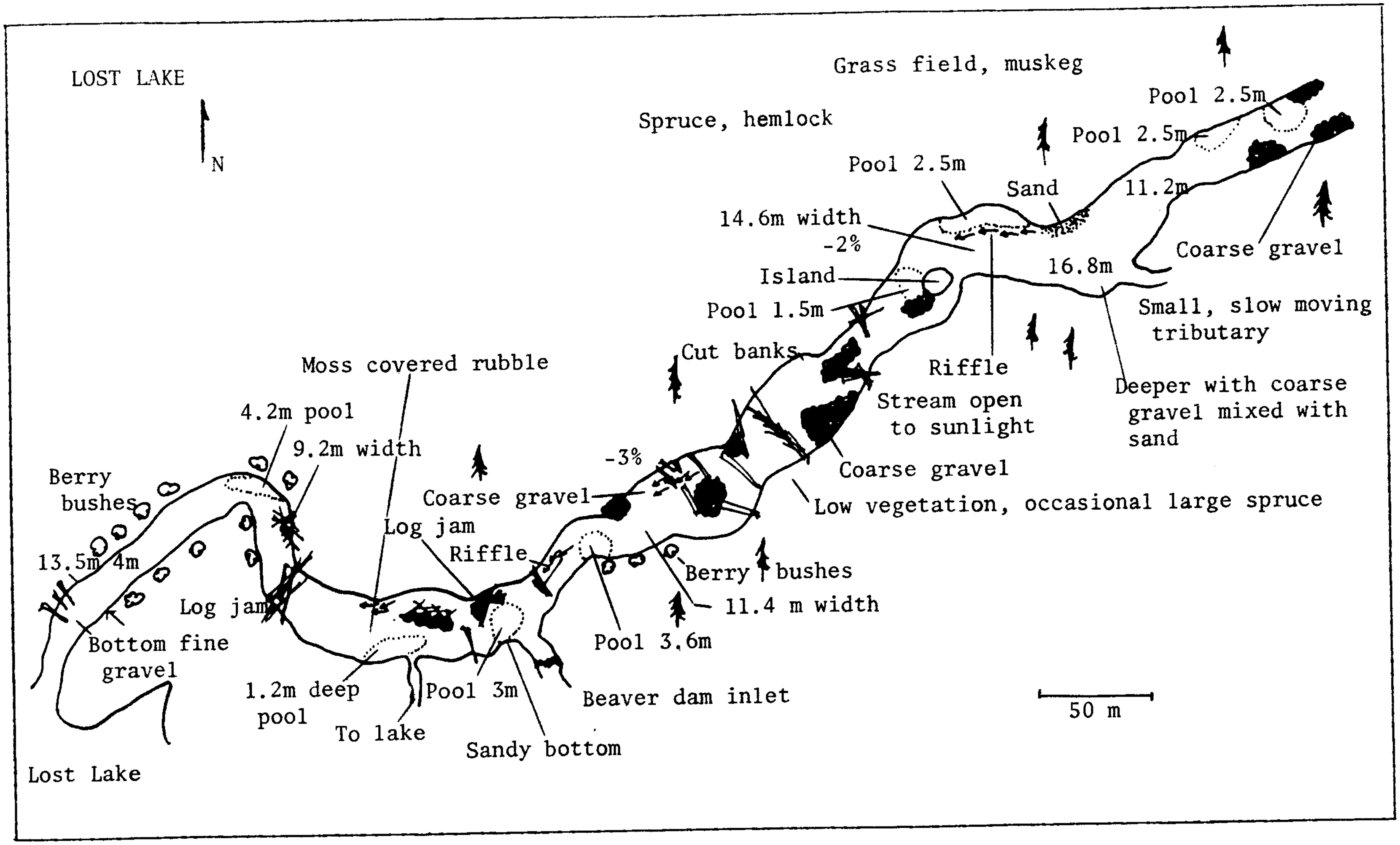

Fig. 3. (Cont.) Map showing main inlet (lower section) to Lost Lake.

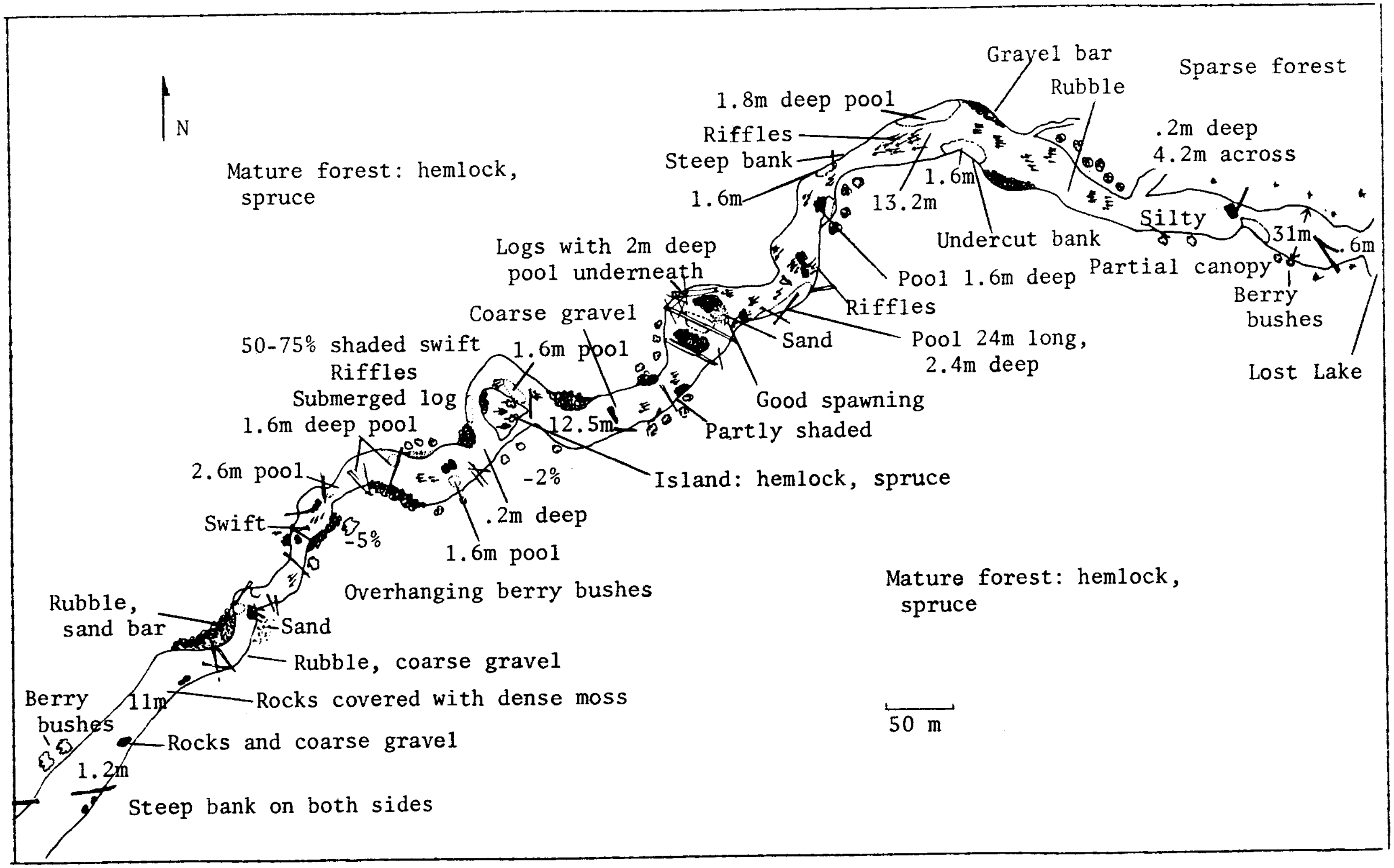

Fig. 4. Map showing stream (upper section) between Lost Lake and Swan Lake.

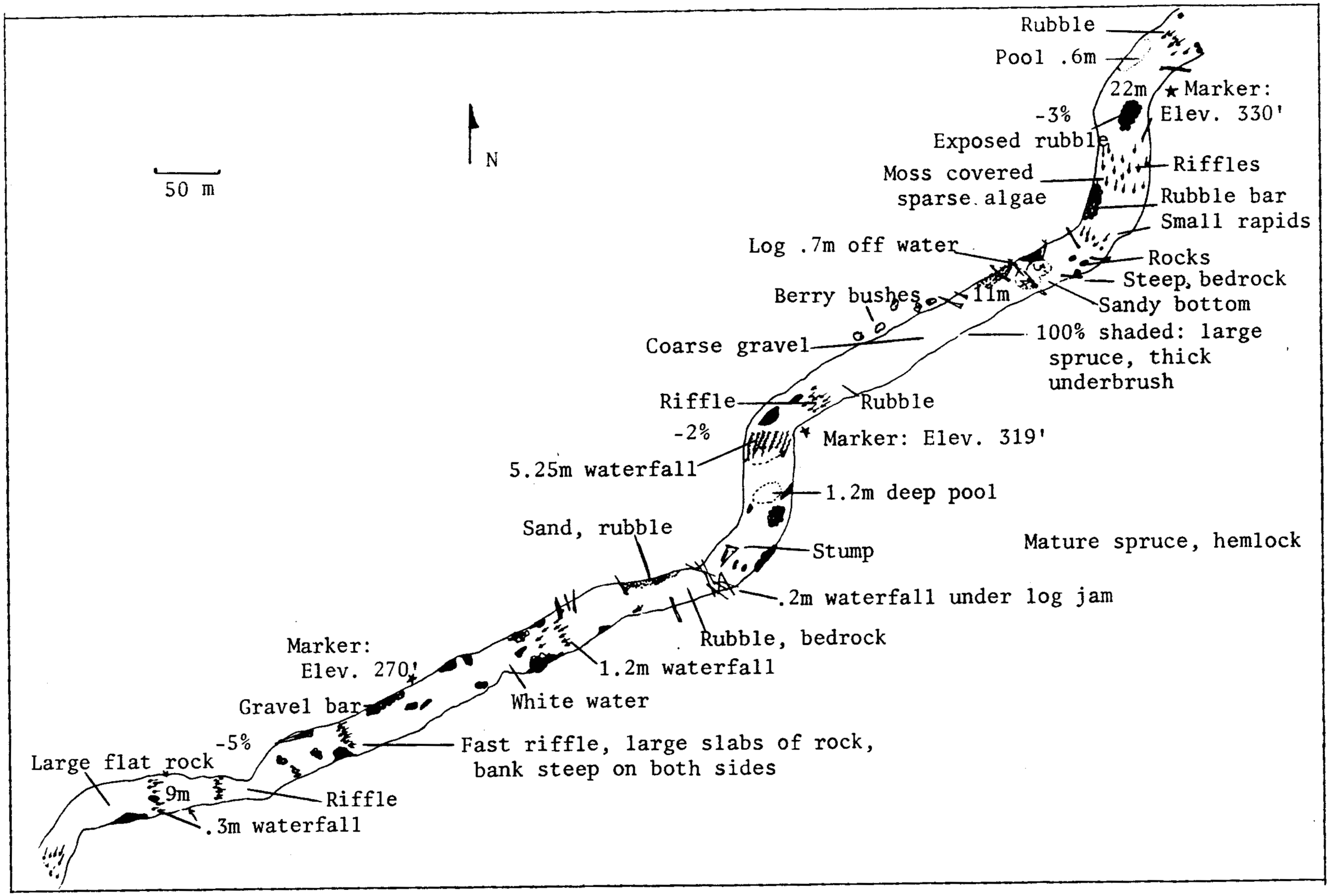

Fig. 4. (Cont.) Map showing stream (middle section) between Lost Lake and Swan Lake.

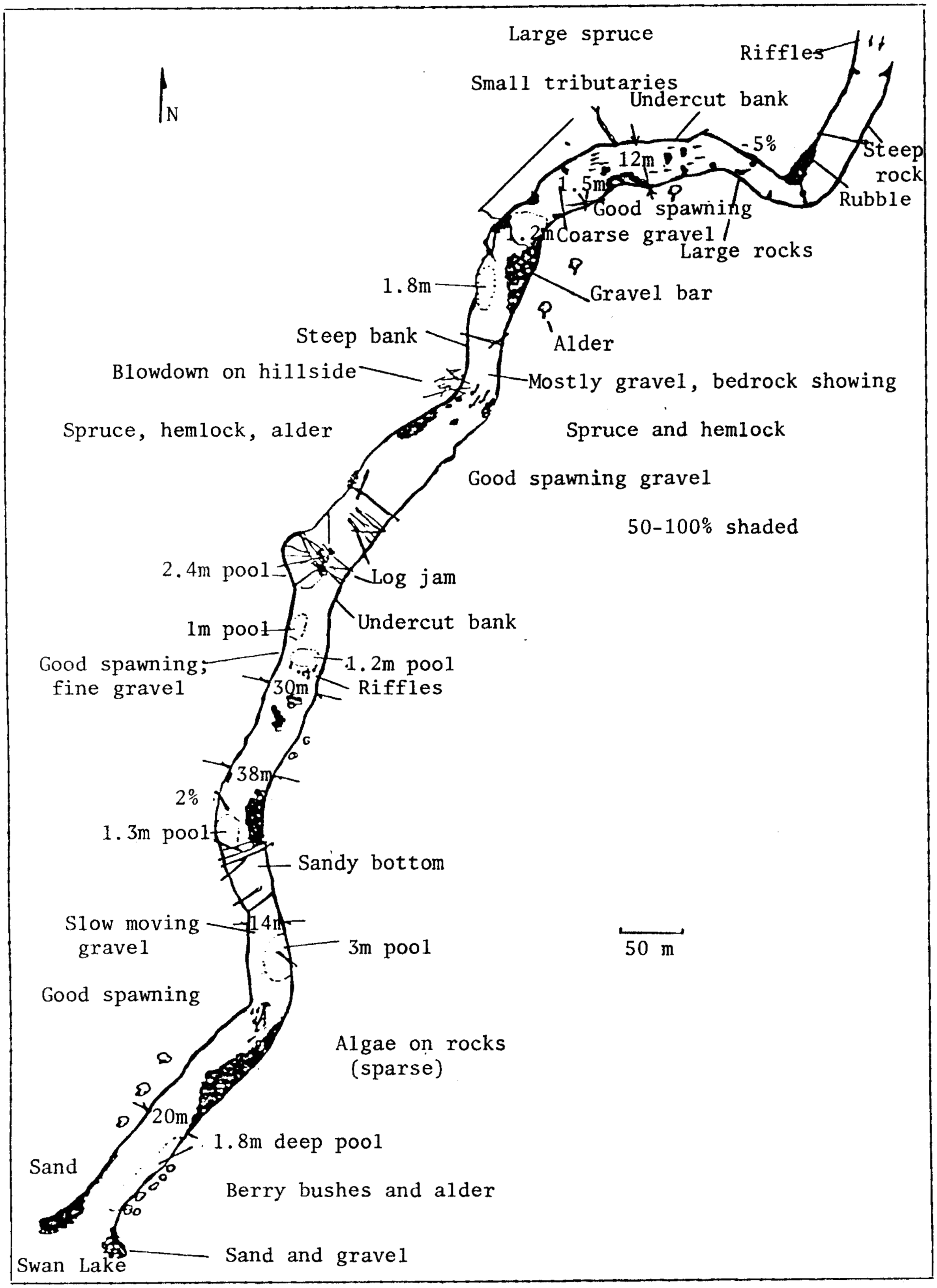

Fig. 4. (Cont.) Map showing stream (lower section) between Lost Lake and Swan Lake.

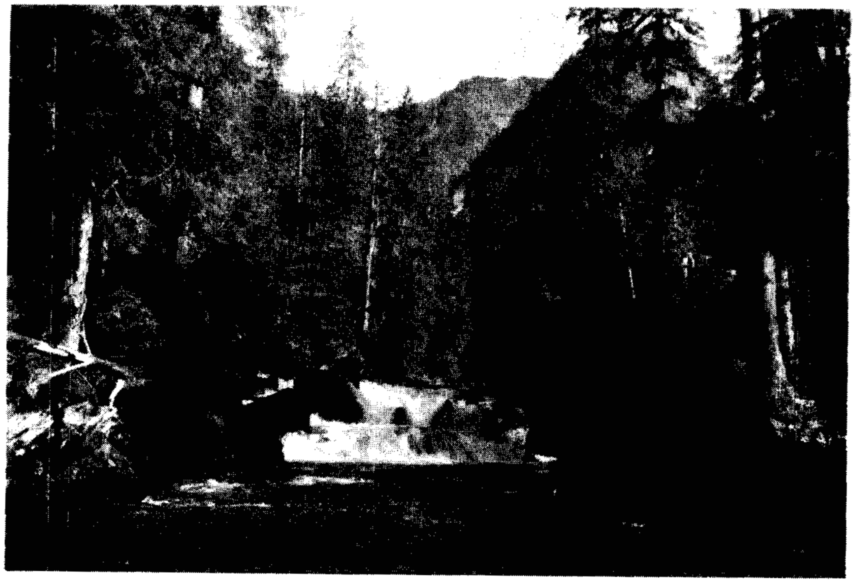

Fig. 5. Waterfall on stream between Lost Lake and Swan Lake.

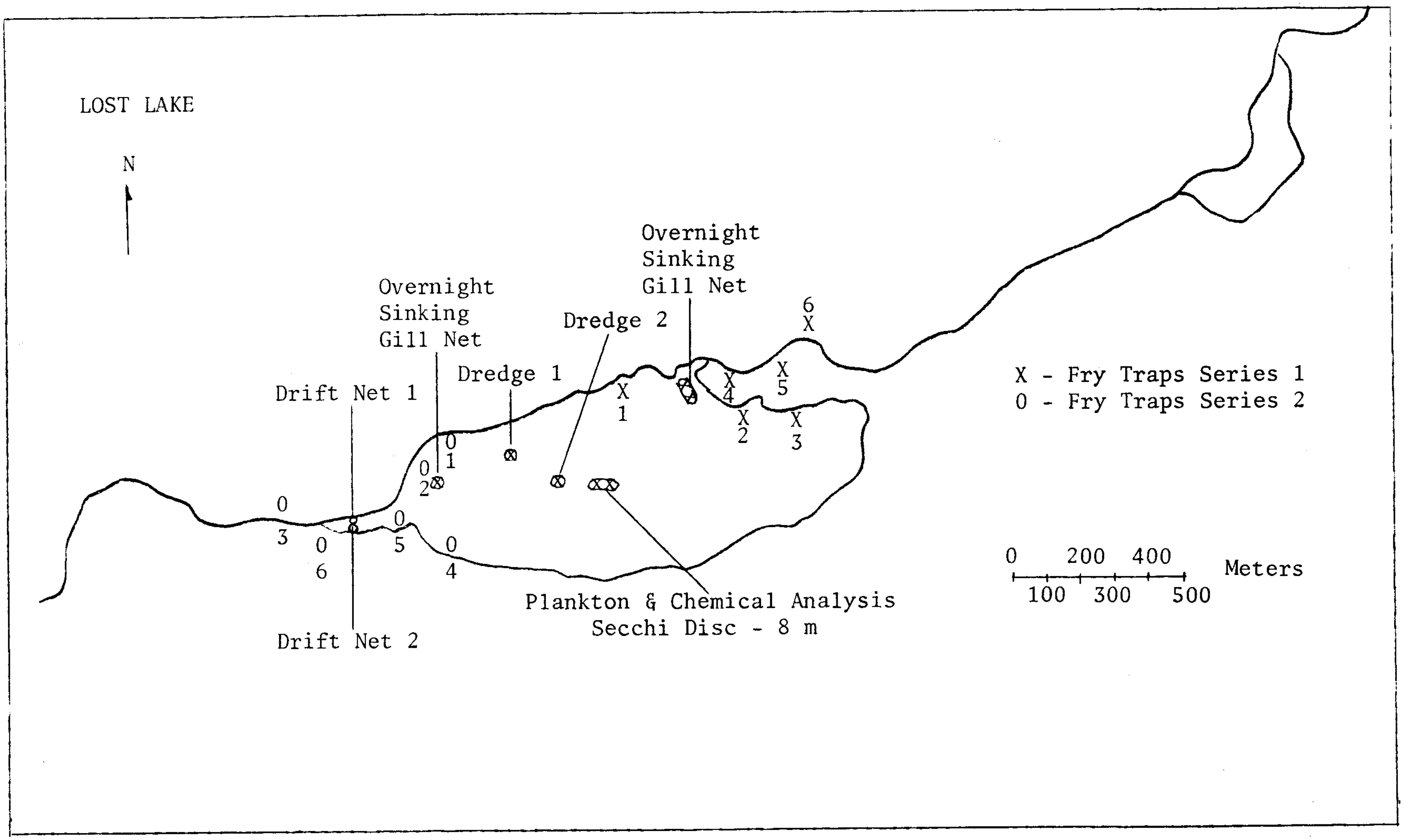

Fig. 6. Map showing location of sampling stations, Lost Lake, 1979.

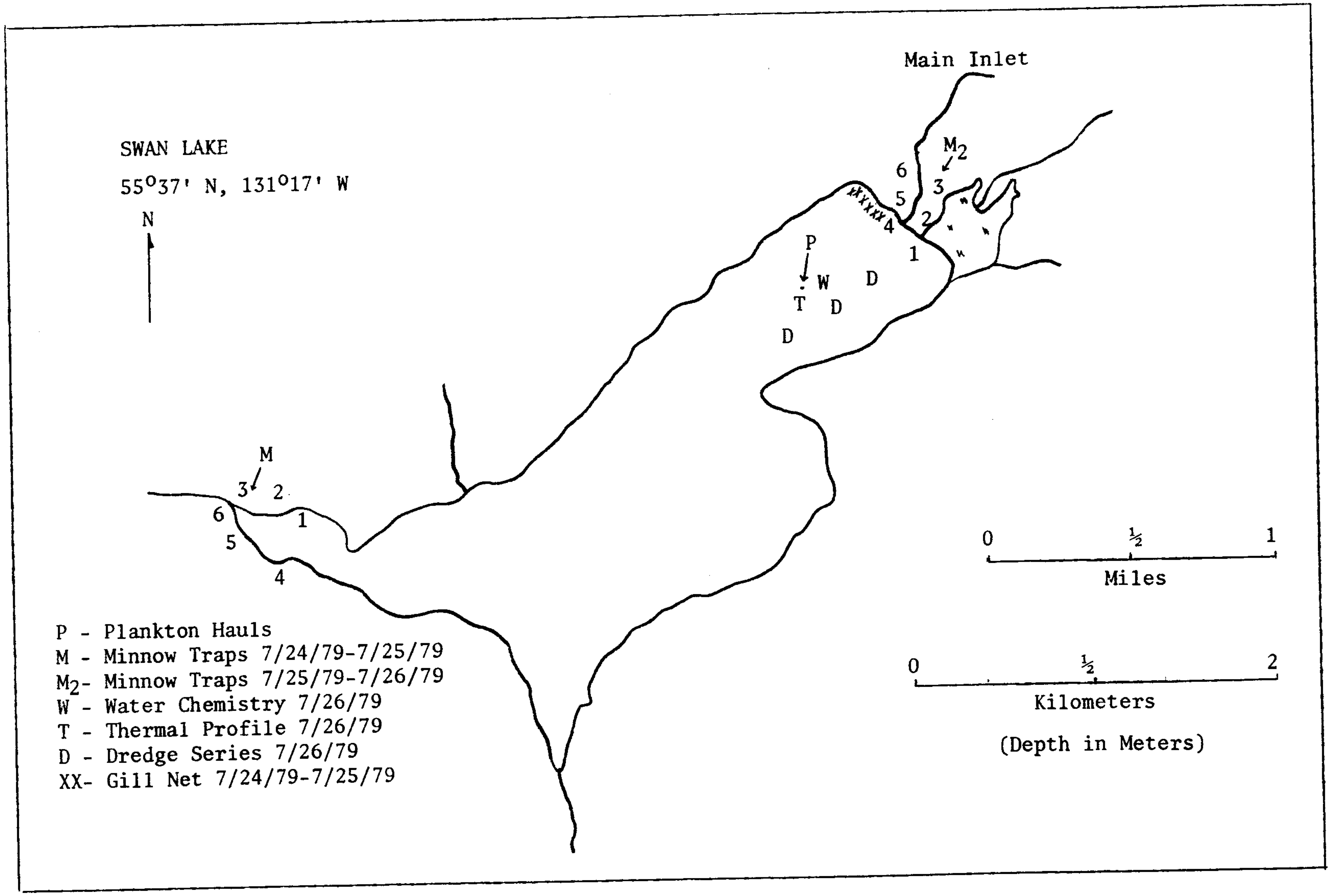

Fig. 7. Map showing location of sampling stations, Swan Lake, 1979.

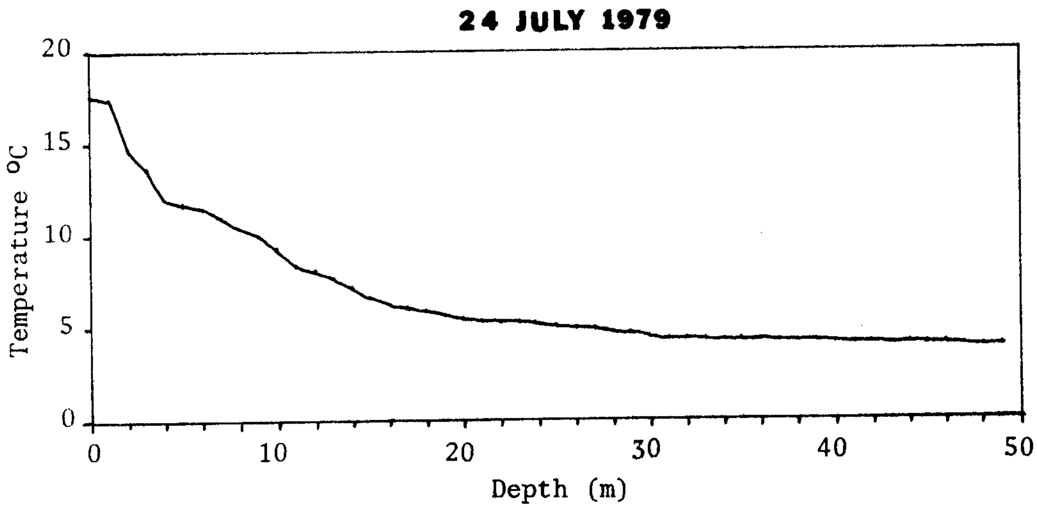

Fig. 8. Thermal profile of Swan Lake, 1979.

Table 3. Water quality analyses of Lost and Swan Lakes, 1979.

Parameter, Unit	Lost Lake	Swan Lake (Ketchikan)
Specific Conductance, umho	16.000	21.000
pH	6.700	6.850
Hardness, mg/l	6.000	8.000
Alkalinity, mg/l	6.600	6.800
Calcium, mg/l	0.759	1.495
Magnesium, mg/l	0.212	0.238
Sodium, mg/l	0.720	0.794
Potassium, mg/l	0.428	0.443
Iron, mg/l	0.148	0.085
Manganese, mg/l	0.003	0.002
Molybdenum, mg/l	0.020	0.020
Aluminum, mg/l	0.070	0.190
Boron, mg/l	0.100	0.100
Silica, mg/l	1.900	1.700
Fluoride, mg/l	0.010	0.010
Chloride, mg/l	1.000	1.000
Sulfate, mg/l	2.500	4.000
Nitrate, mg/l	4.200	4.800
Nitrite, mg/l	0.010	0.010
Ortho-Phosphate, mg/l	0.010	0.010

Table 4. Plankton composition, density (organisms per square meter), and weight (milligrams per square meter) as collected with No.-153 Nitex plankton nets, Lost and Swan Lakes, 1979.

Lake	Lost Lake	Swan Lake (Ketchikan)
Date	June 28, 1979	July 25, 1979
Depth of Tow (m)	30	100
Copepoda		
Cyclopoid	20,156	22,141
Nauplii	7,228	4,072
Harpacticoid	51	0
Calanoid	1,120	4,479
Nauplii	713	0
Cladocera		
Ceriodaphnia	204	102
Chydorus	51	0
Holopedium	0	204
Daphnia	2,086	2,188
Bosmina	2,392	13,590
Rotatoria		
Conochilus	356	219,888
Keratella	1,985	0
Collotheca	0	12,216
Asplancha	4,021	33,237
Kellicottia	4,835	79,404
Polyphemus	0	1,018
Polyarthra	0	44,792
Dry Weight	137.4	243.3
Organic Weight	104.3	220.4
Ash Weight	33.1	22.9

Table 5. Summary of fish sampling effort and catch data from Lost and Swan Lakes, 1979.

Lake and Date	Location	Gear Type	Total Hours Set	Catch
Lost,				
June 26	Upper End of Lake	Sinking Gill Net	12.00	7 DV (375-562 mm); 3 Kokanee (150-155 mm)
June 27	Inlet Stream	6 Fry Traps	13.00	14 DV (75-150 mm); 1 SC
June 27	Outlet Stream	6 Fry Traps	11.50	11 DV (65-225 mm)
June 28	Lower End of Lake	Sinking Gill Net	13.75	13 DV (115-470 mm); 18 Kokanee (120-170 mm)
Swan (Ketchikan),				
July 24	Upper End of Lake	Sinking Gill Net	17.00	26 DV (130-510 mm); 35 Kokanee (150-185 mm)
July 24	Lake Shore, Lower End	6 Fry Trap	22.00	115 SC; 5 DV (82-193 mm); 10 Salamanders
July 26	Lake Shore, Upper End	6 Fry Traps	20.25	83 SC; 4 DV (60-126 mm); 4 Salamanders

Table 6. Condition factors (K)* of Dolly Varden and kokanee from Lost and Swan Lakes, 1979.

Lake and Species	Number	Condition Factor (K)* $\bar{x}$	Range	Standard Deviation
Lost,				
Dolly Varden	15	1.50	0.88-2.89	0.55
Kokanee	19	1.75	0.94-2.56	0.56
Swan (Ketchikan),				
Dolly Varden	15	0.88	0.46-1.25	0.23
Kokanee	16	1.26	1.12-1.53	0.09

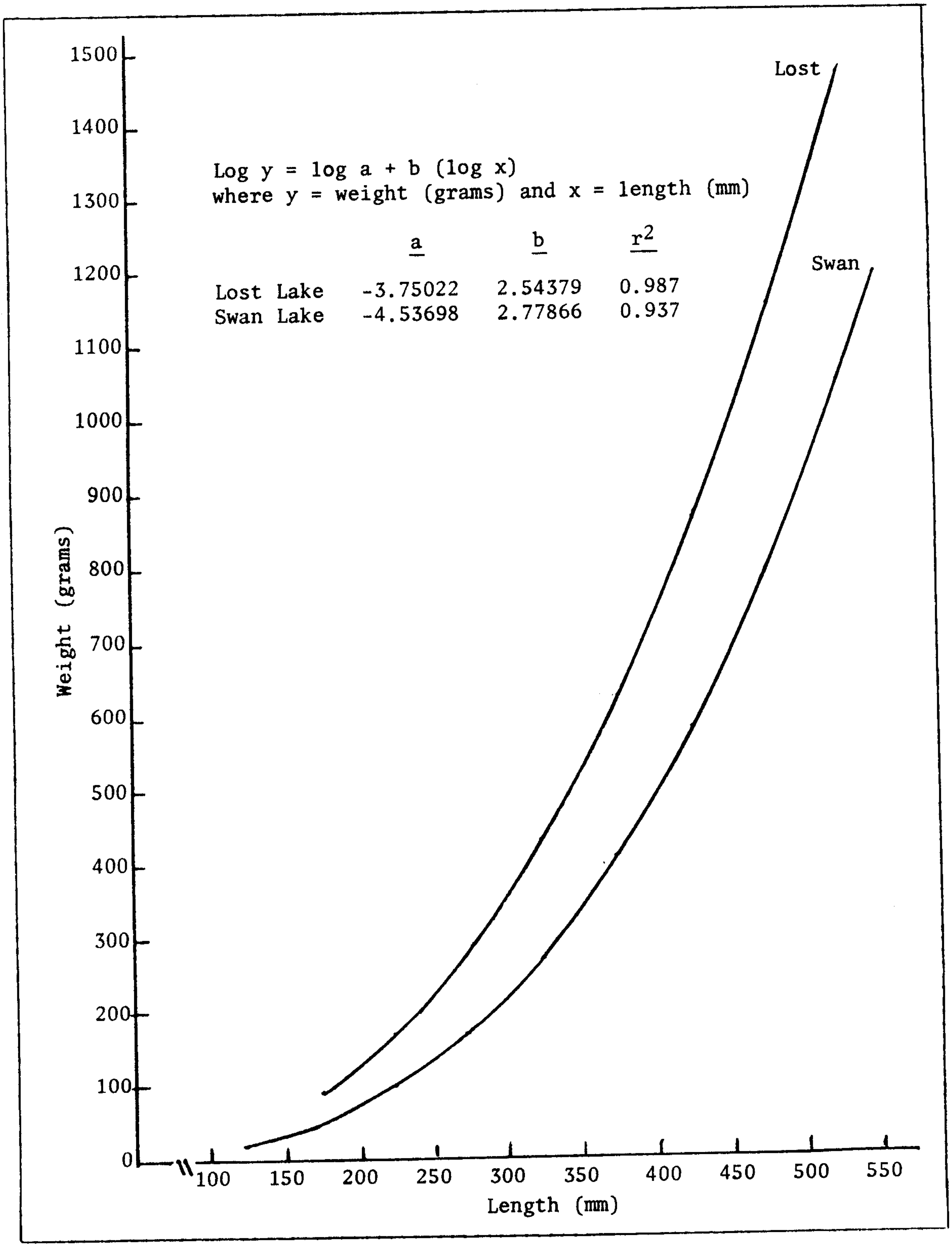

Fig. 9. Length-weight relationship of Dolly Varden from Lost and Swan Lakes, 1979.

Food habit analyses of Dolly Varden from both lakes showed that larger individuals were piscivorous. It was not possible to identify species of fish eaten from decomposed stomach contents.

Several large Dolly Varden (> 1 kg) were found in both lakes. Kokanee were small, none being over 180 mm in length.

SECTION III

OBJECTIVE

3. To determine extent of spawning and rearing area of Vodopad River remaining upon completion of Green Lake Dam.

BACKGROUND

The City and Borough of Sitka, Alaska, received a license for Green Lake Project No. 2818 on April 15, 1979. The issuance of the license authorized the construction of: (1) a dam at the outlet of Green Lake; (2) a power tunnel leading to a powerhouse at tidewater on Silver Bay; (3) a switchyard; (4) access roads; (5) a transmission line; and (6) appurtenant facilities.

Green Lake was originally stocked with brook trout in 1932 and has maintained a fishable population since that time.

The present investigation was conducted to determine the extent of spawning and rearing areas that will remain upon completion of the hydroelectric project.

RECOMMENDATIONS

1. Logging practices conducted during reservoir clearing shall corporate normal stream protection measures for all portions of the Vodopad River above 300-foot elevation. This will protect the remaining streambed which may be available for fish spawning and rearing when water levels in the reservoir are less than maximum.

2. A population estimate of brook trout in Green Lake should be conducted 5 years after impoundment so a comparison can be made with known population densities prior to impoundment.

TECHNIQUES USED

The Vodopad River was walked from a quarter mile below the barrier falls to Green Lake (approximately 3 miles). Observations of stream depth, width substrate, and pool/riffle ratio were made. The area from the top down to about the 290-foot contour mean sea level (msl) was mapped and all pertinent stream characteristics noted on map. This mapped portion of the river approximates the normal working pool elevations of the proposed reservoir (294- to 390-foot msl).

FINDINGS

The stream survey summary (Fig. 10) shows the only really good spawning and rearing area of the Vodapod River to be in the lower river valley. This area will be permanently under water once the dam is completed and reservoir filled. The prime spawning and rearing area of the Vodopad River will therefore be lost.

Fig. 11 shows the stream area which may be exposed during reservoir drawdown. The upper areas of this section had bottom substrate of 0.15 m (6-inch) rubble. The lower part of this stream has a coarse gravel substrate. Pools are infrequent (25% or less of area). Most pools were shallow (less than 1-m depth) and had fairly high water velocity. The river is about 75% shaded with alder, brush, and mature spruce and hemlock.

The upper section of the mapped area has very little spawning potential or rearing area. The lower section which would be exposed only during major reservoir drawdown has moderate spawning potential and rearing area.

SECTION IV

OBJECTIVE

4. To evaluate productivity potential of small lakes on the Juneau and Sitka road systems and evaluate feasibility of establishing put-and-take fisheries in these lakes.

BACKGROUND

Freshwater sport fishing opportunity in the Juneau area has decreased in recent years with a sharp decline in abundance of Dolly Varden. Fishing effort on the roadside in Juneau has continued to increase steadily for the past several years. In 1977 the roadside fishery had 10,144 angler trips and 35,227 angler hours. In 1979 this had increased to 26,722 angler trips and 59,164 angler hours (Schwan, pers. comm.).

The character of the roadside fishery has changed as the species available has changed. The Dolly Varden which were once abundant have now been nearly eliminated. Pink salmon are now one of the prime target species.

This change in the fishery has limited the opportunity for young anglers to participate. The present study was conducted in an attempt to develop more opportunity for the young angler in an urbanized area.

ALASKA DEPARTMENT OF FISH AND GAME
DIVISION OF SPORT FISH
STREAM SURVEY SUMMARY

STREAM Vodopad River

LOC. Sitka

MAP REF. Port Alexander D-4 LAT. 56°57' N LONG. 135° W
TRIBUTARY TO. Green Lake MAIN DRAINAGE
ORIGIN Runoff LENGTH Approximately 3 miles walked WATERSHED AREA

1. FLOW
RANGE 230 cfs VELOCITY AVG. WIDTH 36 feet AVG. DEPTH 1.56 feet
FLOOD HEIGHT Unknown COLOR/TURBIDITY Glacial to clear

2. ACCESSIBILITY Floatplane or helicopter; there will be a logging road from Green Lake power plant

3. ACCESS STATUS No facilities in the river or in the upper end of Green Lake

4. SECTION SURVEYED ¼ mile below upper waterfalls; down to Green Lake
TRIBUTARIES

5. BOTTOM TYPE Rubble and some areas of coarse gravel STREAM GRADIENT 2-4% %

6. POOLS - DESCRIPTION & FREQUENCY 25-75% pool riffle combination; pools smaller than stream width; water velocity seemed high through most of the pools

7. BARRIERS Waterfalls on both branches approximately 3 miles from Green Lake

8. SPAWING AREA Some good gravel in lower section walked

9. BANK COVER 75% shaded with mature spruce, alder, hemlock, and some cedar

10. WATERSHED TYPE Mountainous, wooded

11. FISH SPECIES Brook trout planted in Green Lake in 1932

12. FISHING HISTORY Some fishing in Green Lake; river not easily fished due to brush on banks

13. FISHING INTENSITY Light

14. INVERTEBRATES No samples taken
ABUNDANCE

15. AQUATIC VEGETATION Very little (sparse algae)

16. WATER USE None (Green Lake will be dammed for hydro plant)

17. POLUTION None

18. REMARKS

BY Kevin Smith DATE 07/09/79

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Fig. 10. Stream survey summary of Vodopad River, 1979.

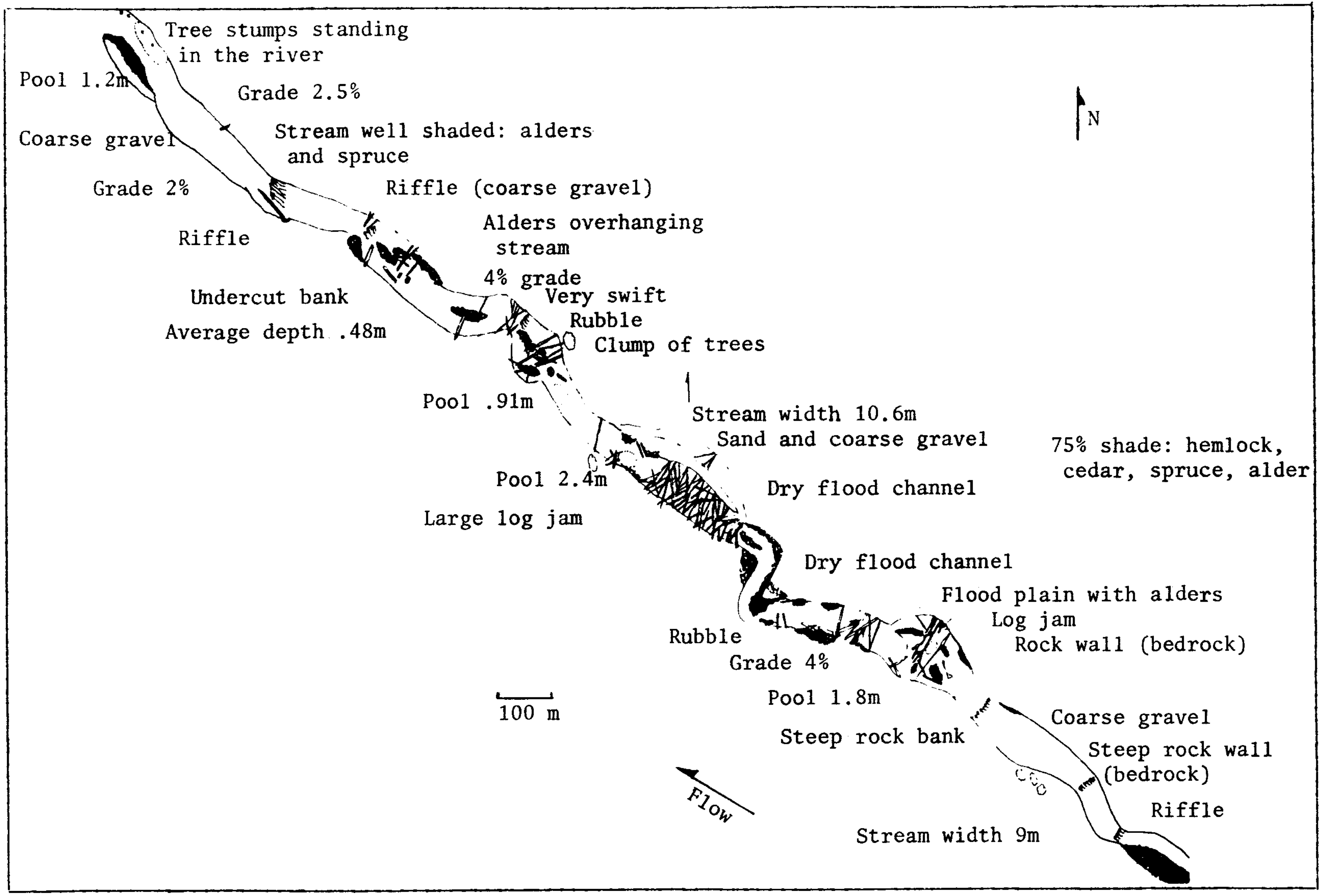

Fig. 11. Map showing main inlet (Vodopad River, upper section) to Green Lake, which will be exposed during reservoir drawdown.

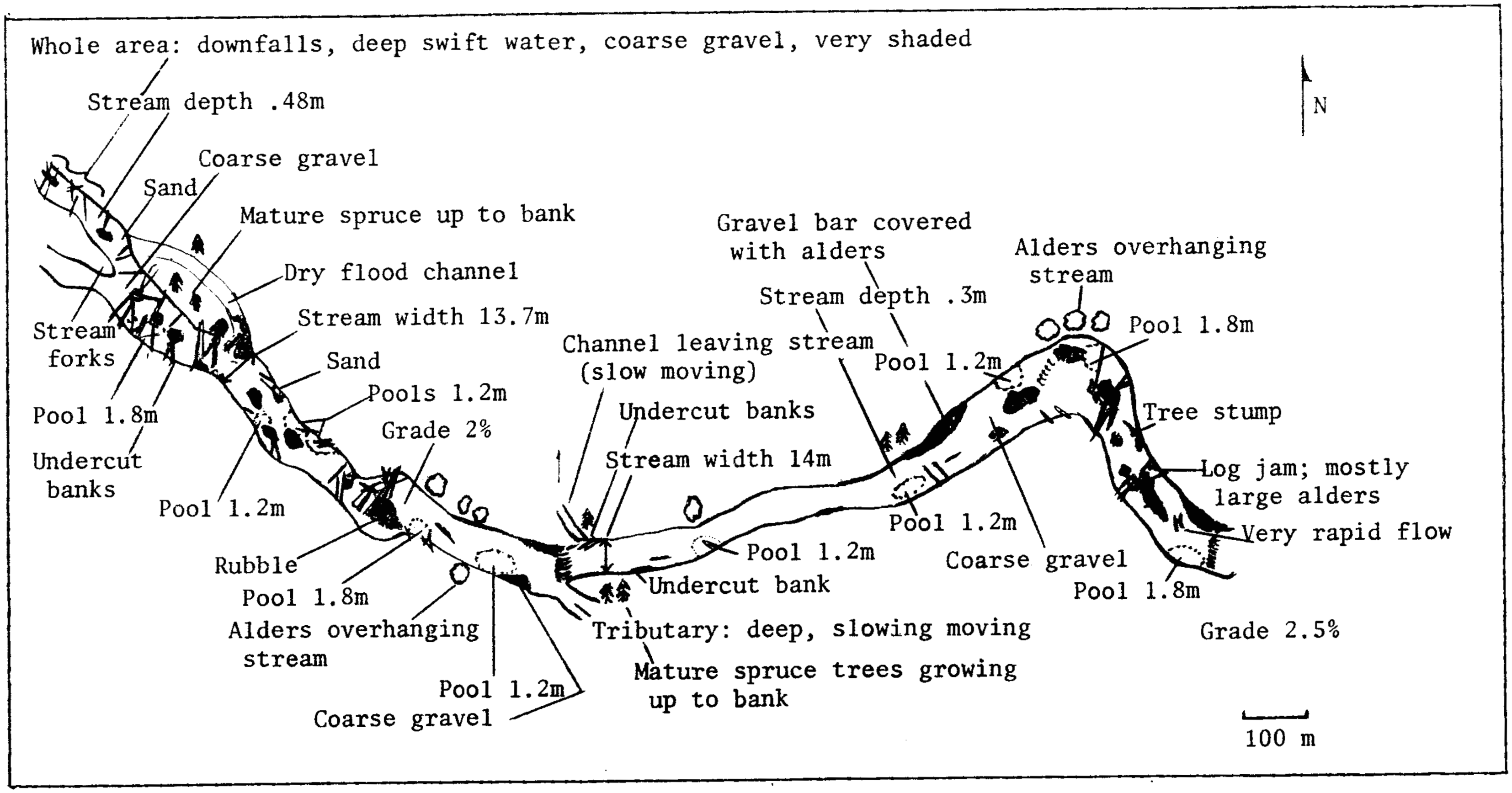

Fig. 11. (Cont.) Map showing main inlet (Vodopad River, lower section) to Green Lake, which will be exposed during reservoir drawdown.

RECOMMENDATIONS

Management recommendations for each lake or pond follow.

Airport Pond, Juneau

It is doubtful that the pond would support a significant population of rearing fish due to salinity extremes and unstable plankton populations. If fish were to be planted on a put-and-take basis, flow gates would have to be modified to prevent fish emmigration. Aircraft landing and takeoff would preclude any boat use on the pond.

Beaver Lake, Sitka

No other fish should be planted in the lake as Arctic grayling are utilizing the available food source, exhibit good growth rates, and are maintaining a fishable population.

Bessie Pond, Juneau

No management actions recommended.

Bridget Pond, Juneau

The only logical fish to plant in a lake with the above conditions would be cutthroat trout. The economics of such an introduction would have to be considered, as the pond is quite remote.

Glacier and Moraine Lakes, Juneau

It is not reasonable to expect these lakes to support fishing pressure without a put-and-take type fishery.

Development of a put-and-take fishery should be oriented toward young people and should include a fish species which would utilize the large stickleback population. Stomach analyses suggests that cutthroat trout would be a good candidate. Coho salmon reared to about 200 mm could also be a candidate species. If possible, the lakes should be blocked or weired to prevent emmigration during high water periods.

Marshall Pond, Juneau

The pond isn't large enough to support a large fish population, and public access is not good. Consequently, a put-and-take fishery is not recommended. If a put-and-take fishery is considered, it should be oriented toward young people. Catchable coho salmon would be a possibility.

Swan Lake, Sitka

The only species which should be considered for introduction would be one which would feed on threespine stickleback.

TECHNIQUES USED

Limnological relationships existing in several small lakes were investigated. Lakes included Airport and Marshall Ponds and Glacier and Moraine Lakes in Juneau and Beaver and Swan Lakes in Sitka. Twin Lakes in Juneau were scheduled for study but had been drained so were not available. Cursory investigations were conducted on Bridget and Bessie Ponds near Juneau.

Each of the lakes was sampled every third week. In addition, a field collection trip was made to each lake during the fall turnover period to gather comprehensive water quality data. Sampling stations were established at approximately the deepest portion of each lake. Vertical profiles of temperature and specific conductance were recorded at each station. Water samples for comprehensive chemical analyses were collected and preserved at each station. Field chemical analyses, including alkalinity titrations, were conducted according to Standard Methods (1971). Comprehensive chemical analyses on preserved samples were conducted by Environmental Services Ltd.

A recording fathometer was used to record depth contours on transects crossing each lake. The depth contours were transferred to bathymetric maps, and morphometric data were calculated from these maps.

Zooplankton were collected by making duplicate vertical tows from the lake bottom with each of two nets. Nets used were 0.5 m diameter and 3 m long. Straining cloth of the No. 153 Nitex Net had aperture of 153 microns and 45% open area. Plankton were identified and counted. Dry and ash weight of plankton were determined gravimetrically. Efficiency of nets was not accounted for in calculations. Thermal profiles and Secchi disc readings were taken in conjunction with plankton tows.

Bottom fauna were collected by dredging with an Ekman 6-inch dredge. Bottom samples were washed through three screens, the finest having 28 meshes per inch. Organisms were preserved in 70% ethyl alcohol until laboratory analysis.

Adult and juvenile fish were collected by hook and line, gill nets and fry traps. Age, growth and food habits of fish in the lakes were determined from fish collected throughout the study period.

Rainbow trout were collected from Sashin Lake on Baranof Island for disease testing.

FINDINGS

Morphometry

Most lakes studied had maximum depths of less than 10 m. Maximum depths are as follows: Beaver Lake, 22 m; Bessie Pond, 4 m; Bridget Pond, 15 m; Glacier Lake, 7 m; Marshall Pond, 3 m; Moraine Lake, 4 m; Swan Lake, 3 m; and Windfall Lake, 5 m. Bathymetric maps of Glacier and Moraine Lakes were drafted by Bethers, 1974. Maps of Beaver and Swan Lakes were completed by Schmidt and Robards, 1975. A bathymetric map of Windfall Lake is presented in Fig. 12.

Physical and Chemical Considerations

Observations of temperature, Secchi disc visibility, pH, conductivity, alkalinity, and hardness were made on the lakes during the survey period. Locations of sampling stations on all lakes are shown in Figs. 13 through 21. Thermal data and Secchi disc visibility from lakes are presented in Tables 7 and 8. The partial water quality information available for Airport, Bessie, Bridget, and Marshall Ponds are presented in Table 9. Complete water quality information for Beaver, Glacier, Swan, and Windfall Lakes is presented in Table 10.

Plankton

Zooplankton populations were monitored throughout the summer at Beaver Lake (Table 11), Glacier Lake (Table 12), Marshall Pond (Table 13), Moraine Lake (Table 14), and Swan Lake (Table 15). Plankton composition and density from Airport, Bessie, and Bridget Ponds and Windfall Lake were sampled once or twice during the summer. Plankton counts for these waters are presented in Table 16 and identifications shown in Table 17.

Although a standing crop of plankton does not measure production, net plankton samples may show some distinction between oligotrophic and eutrophic lakes. Rawson (1953) stated that the standing crop of No. 20 net plankton measured by total vertical hauls exhibits this distinction in western Canada. He gives this range as 10 to 40 kg/ha dry weight for alpine and large oligotrophic lakes, while mesotrophic and moderately eutrophic lakes have up to 100 kg/ha.

The standing crop of No.-10 net plankton was calculated using an assumed net efficiency of 25%. The organic weight of the three or four heaviest plankton samples collected throughout the summer was averaged for each lake. Average standing crop (organic weight in kg/ha) of No.-10 net plankton was: Beaver Lake, 12.5; Glacier Lake, 8.1; Marshall Pond, 9.5; Moraine Lake, 7.4; and Swan Lake 13.3.

Bottom Fauna

Bottom fauna collected by dredging and screening benthic material are identified and enumerated in Table 18.

Fish

A summary of fish catch and effort information for lakes studied is presented in Table 19. A discussion of the limnology and fishery in each lake and possible methods of enhancement follows.

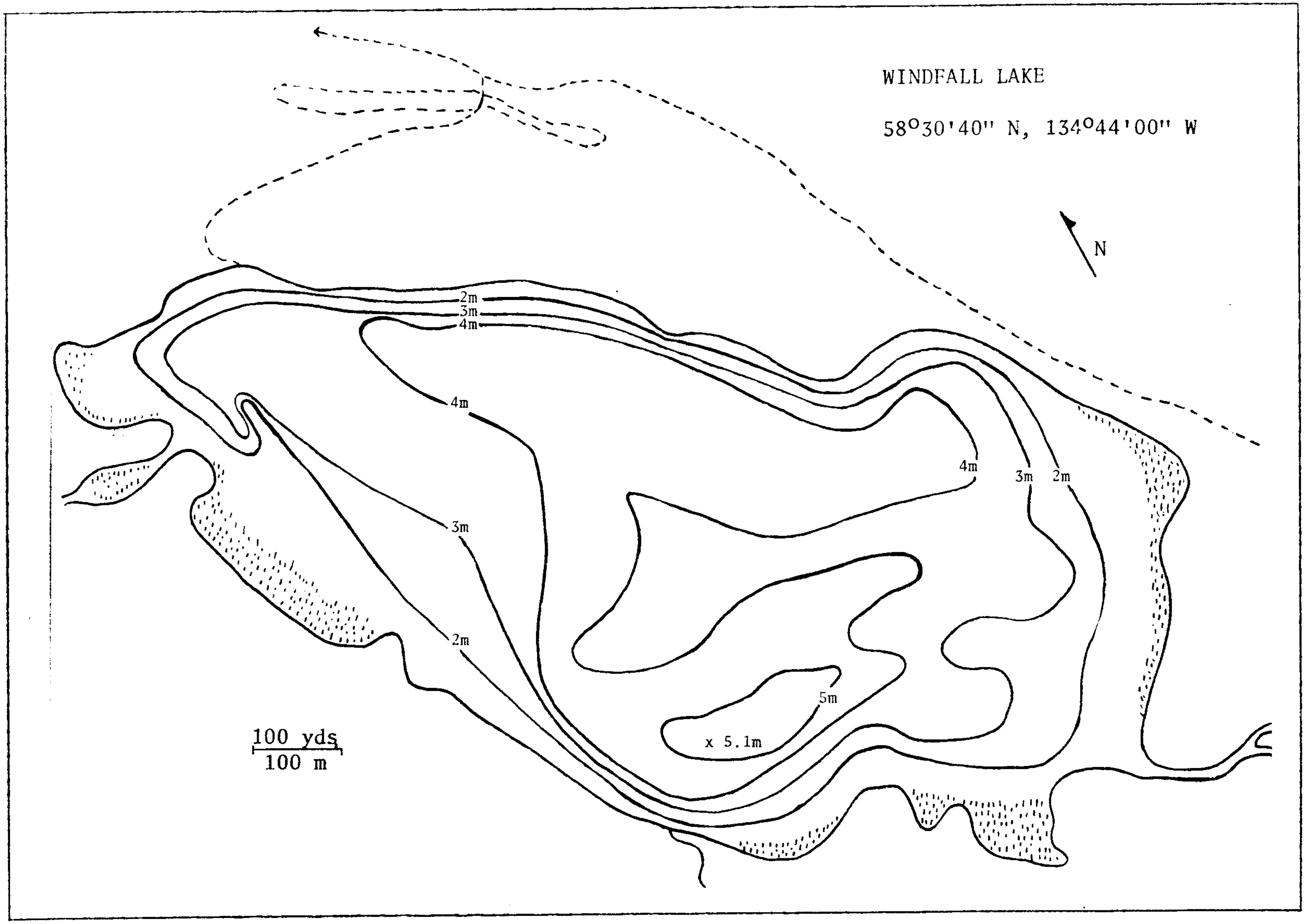

Fig. 12. Bathymetric map of Windfall Lake.

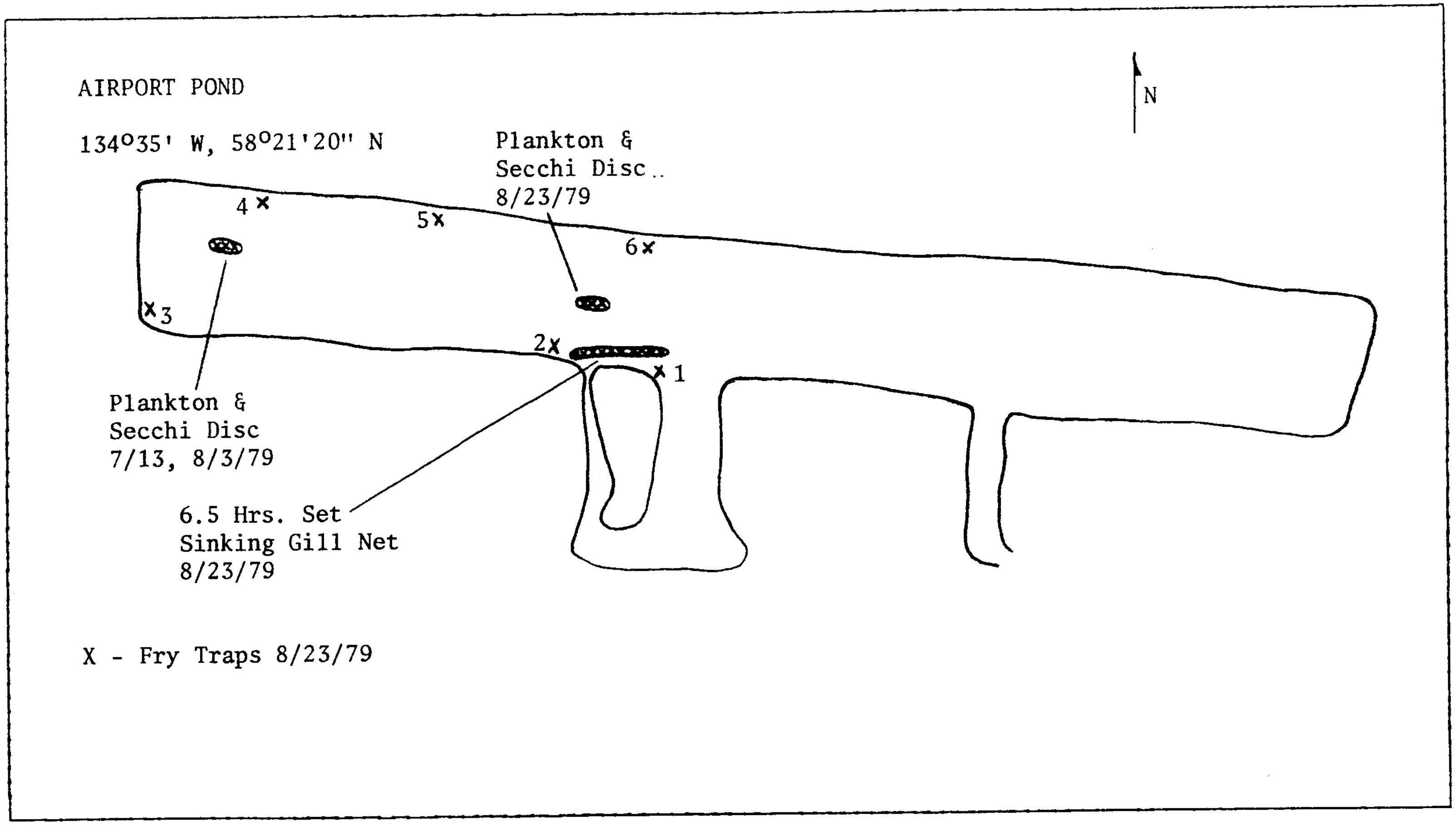

Fig. 13. Map showing location of sampling stations, Airport Pond, 1979.

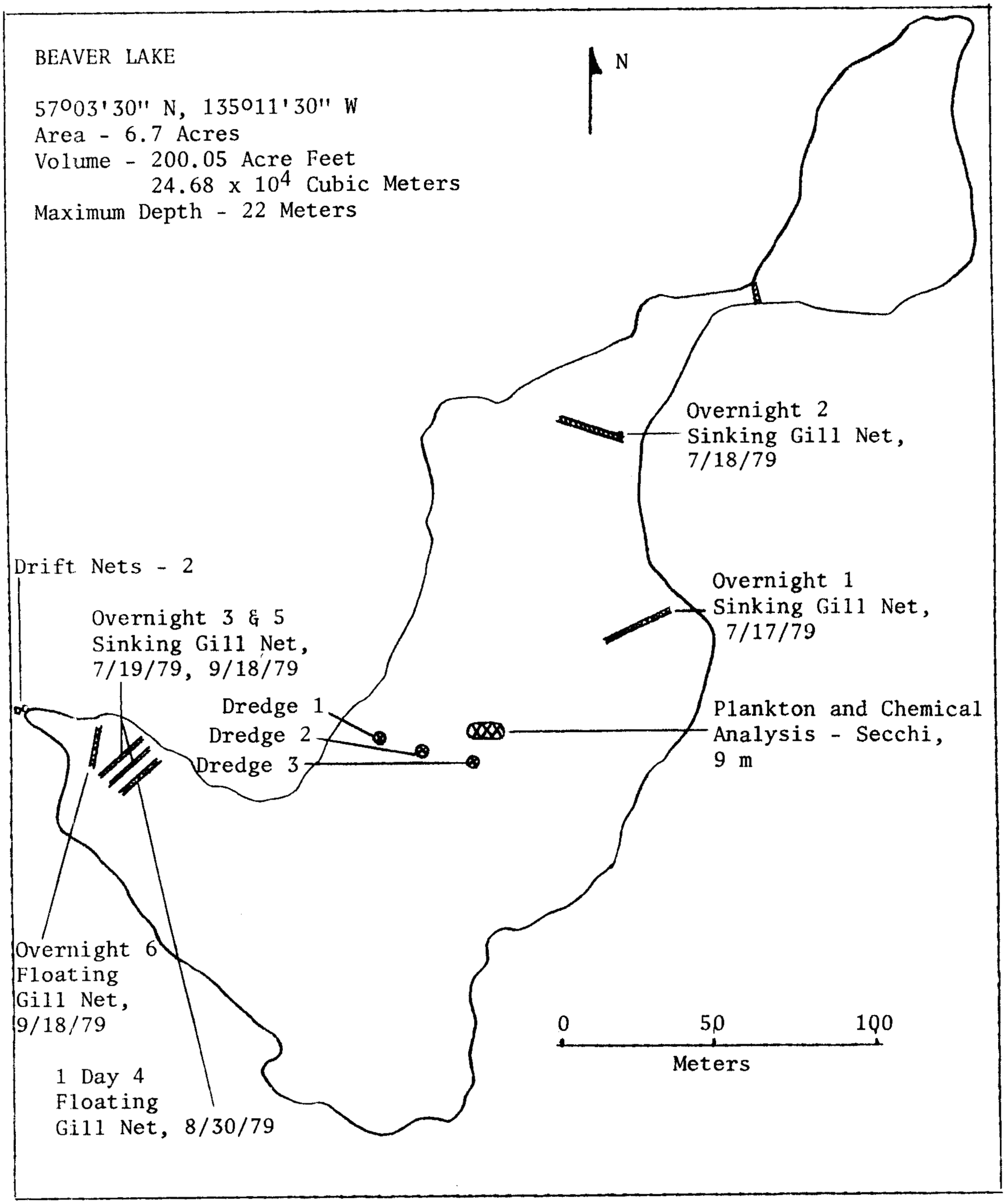

Fig. 14. Map showing location of sampling stations, Beaver Lake, 1979.

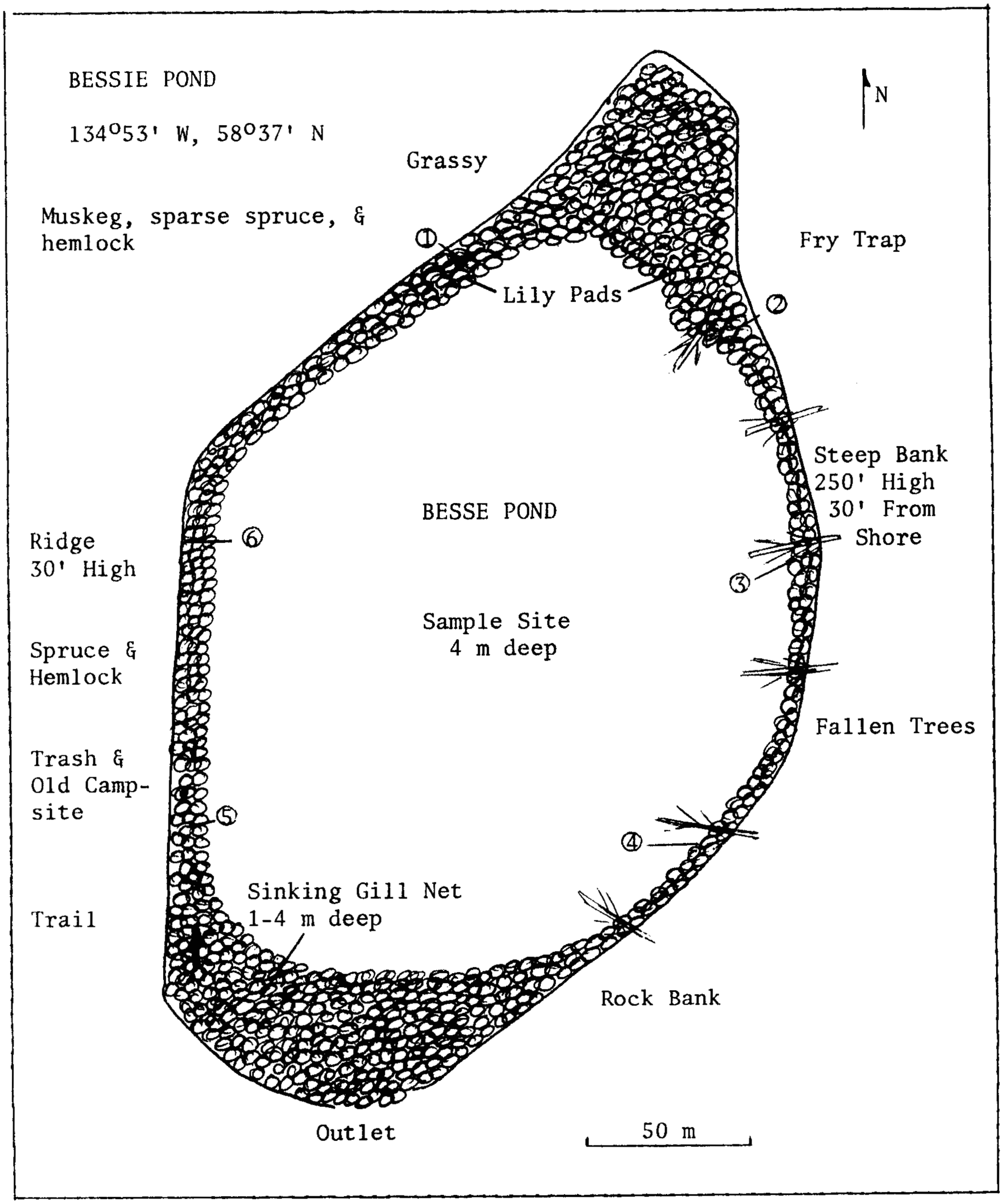

Fig. 15. Map showing location of sampling stations, Bessie Pond, 1979.

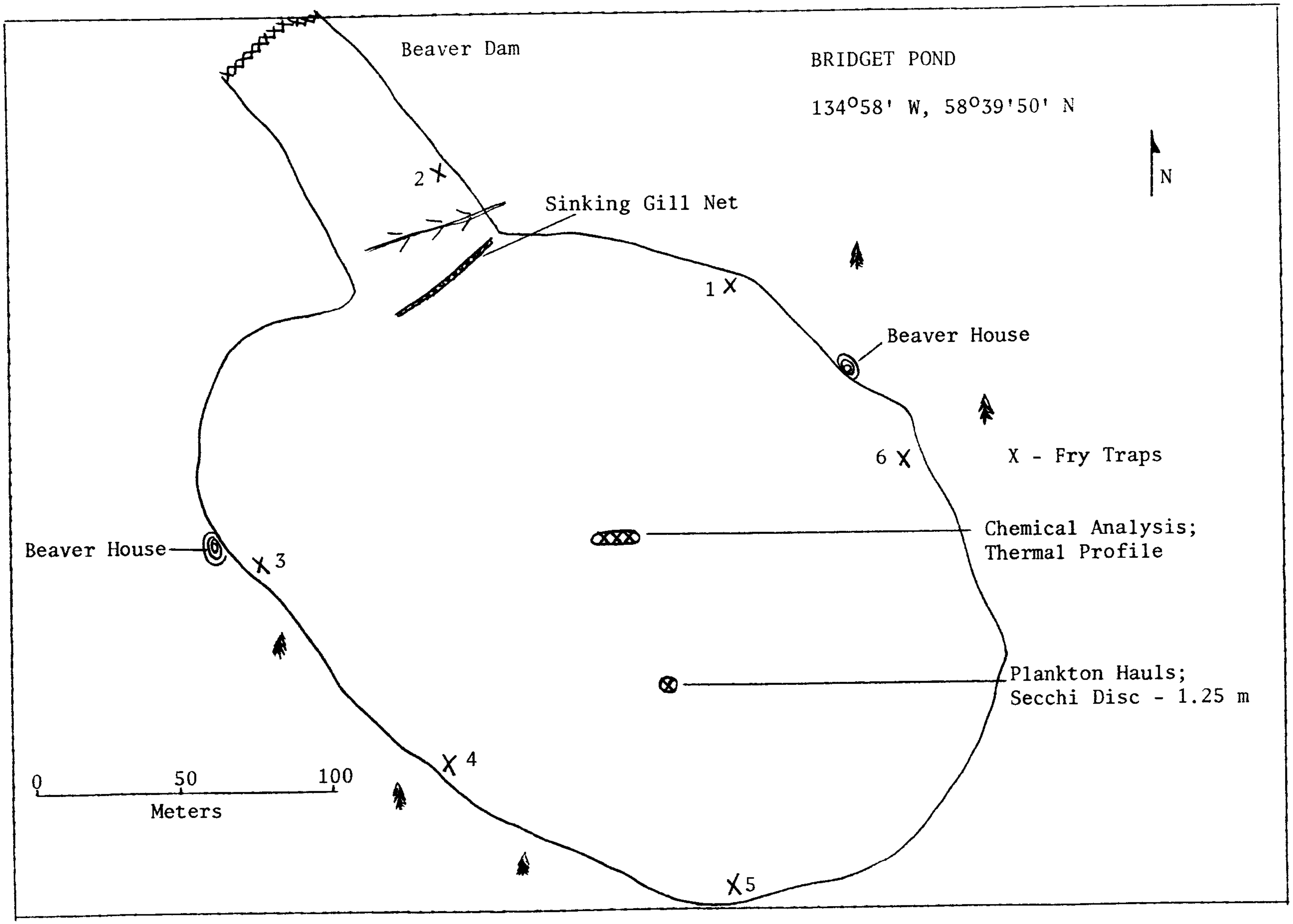

Fig. 16. Map showing location of sampling stations, Bridget Pond, 1979.

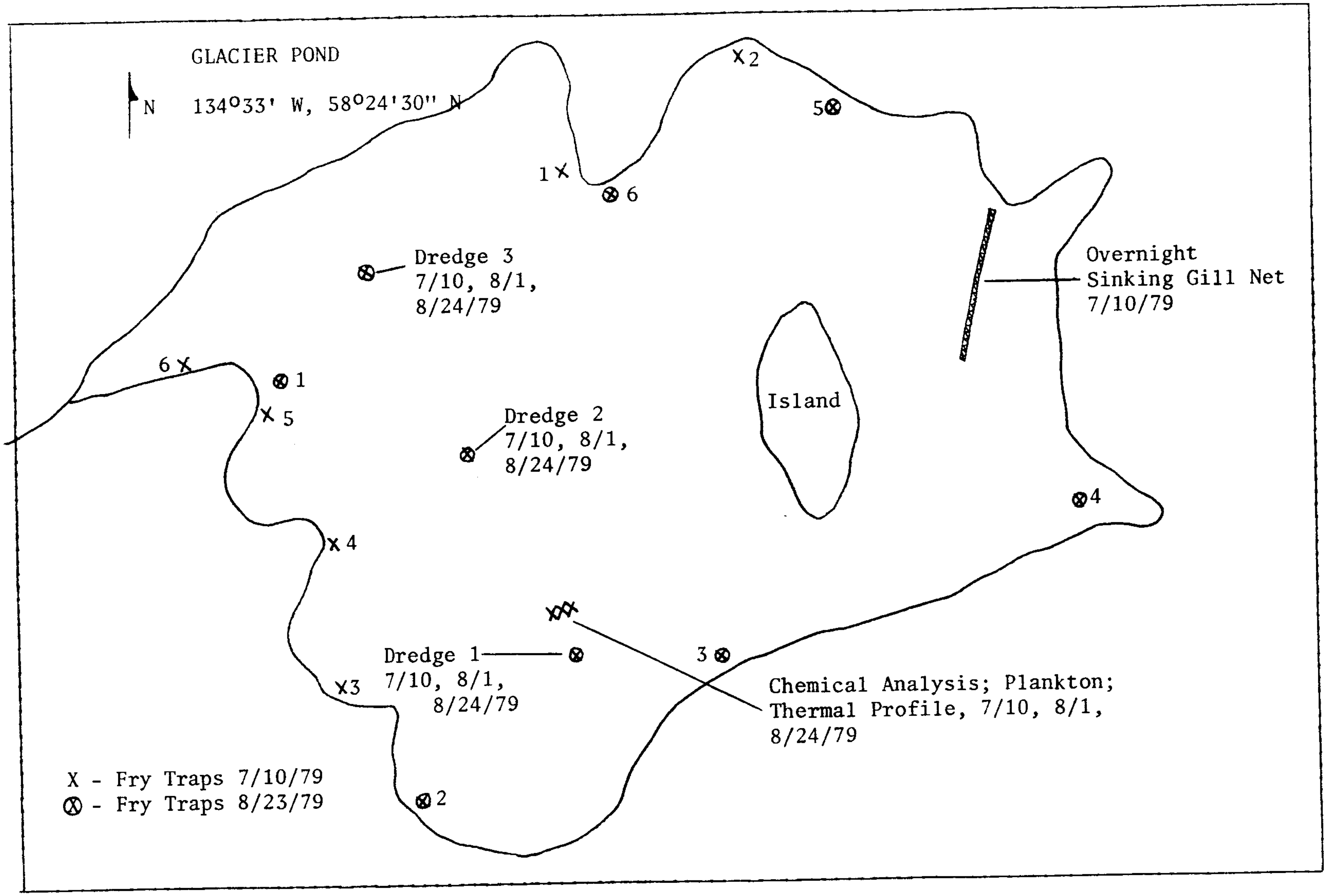

Fig. 17. Map showing location of sampling stations, Glacier Pond, 1979.

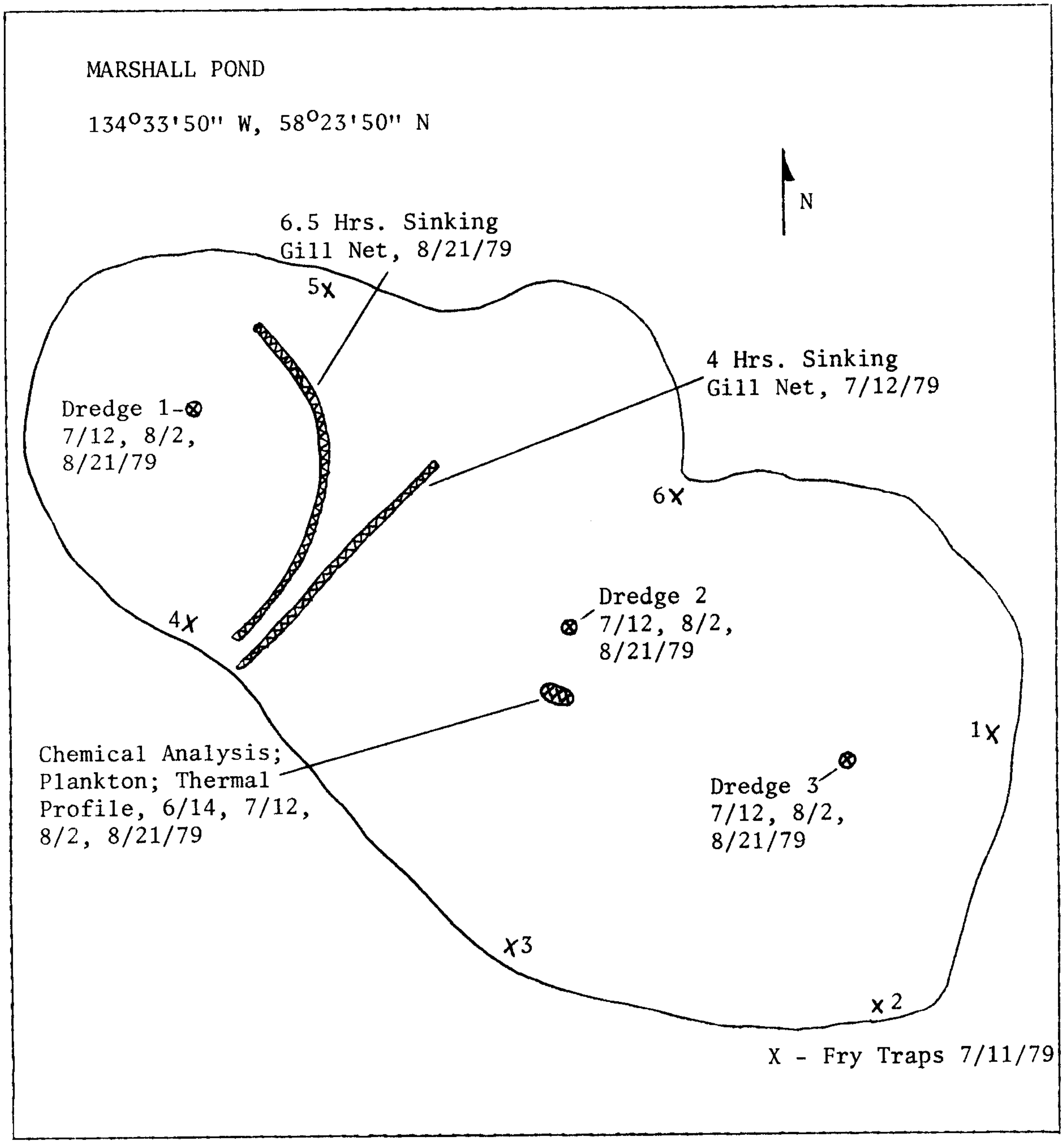

Fig. 18. Map showing location of sampling stations, Marshall Pond, 1979.

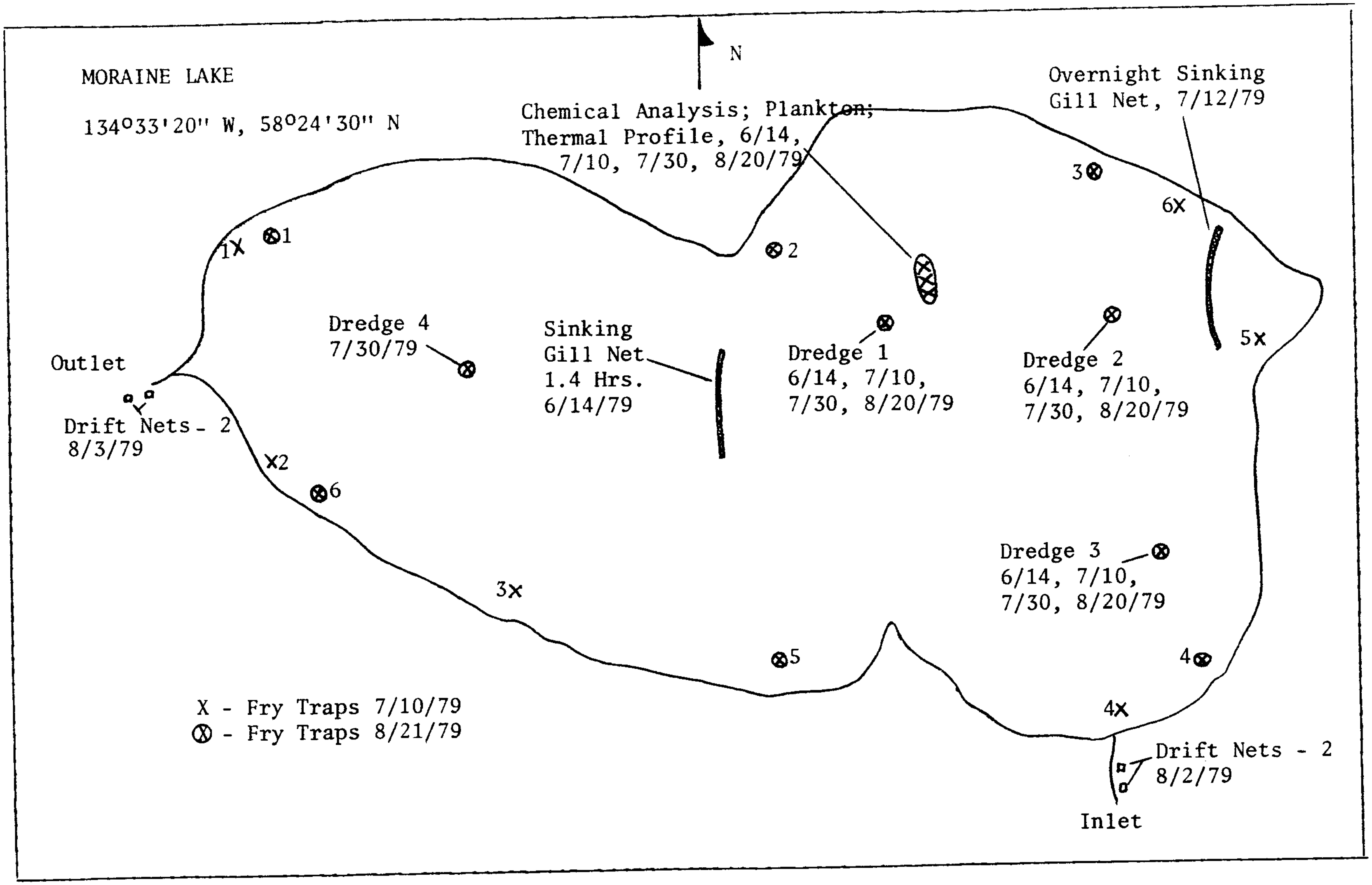

Fig. 19. Map showing location of sampling stations, Moraine Lake, 1979.

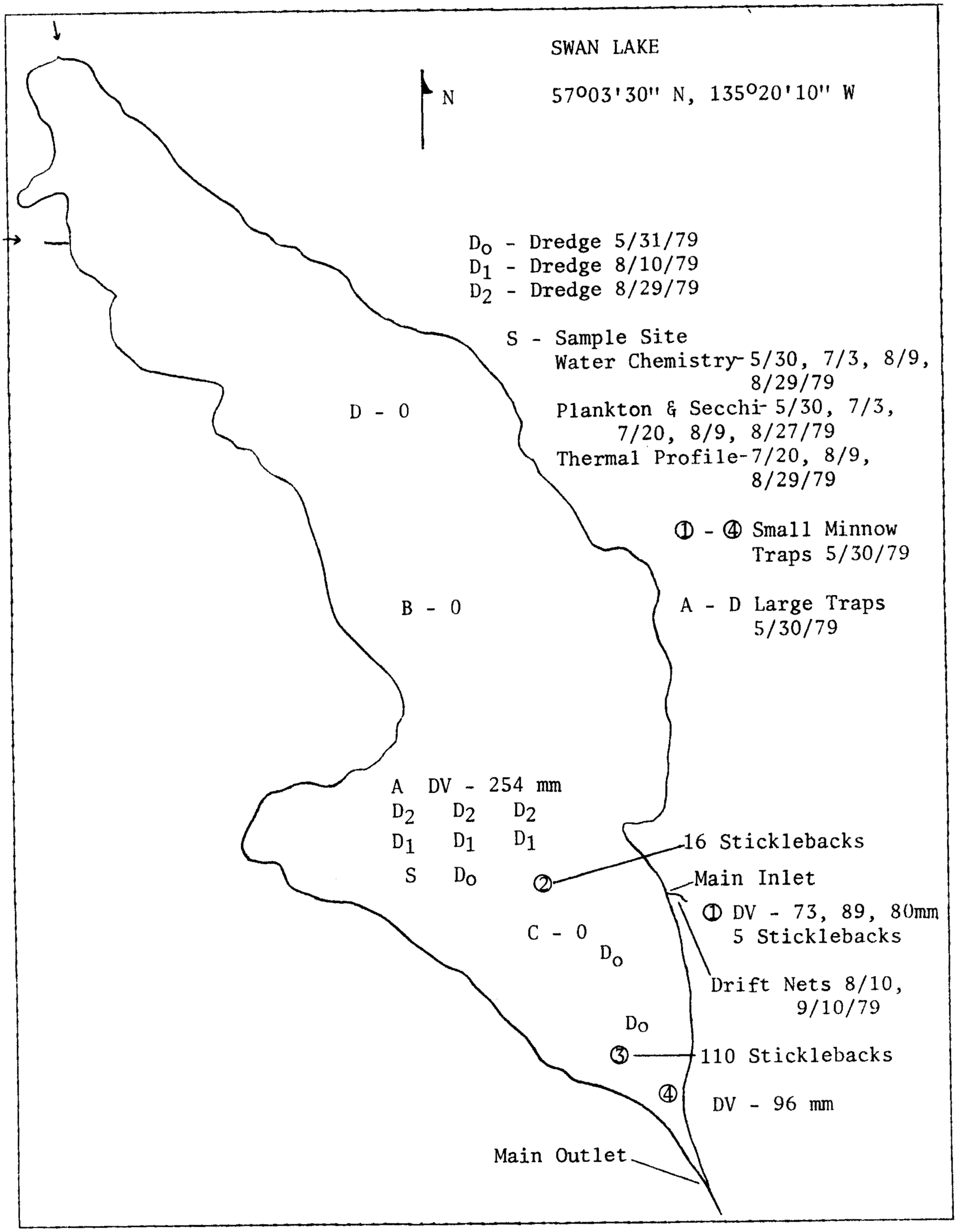

Fig. 20. Map showing location of sampling stations, Swan Lake (Sitka), 1979.

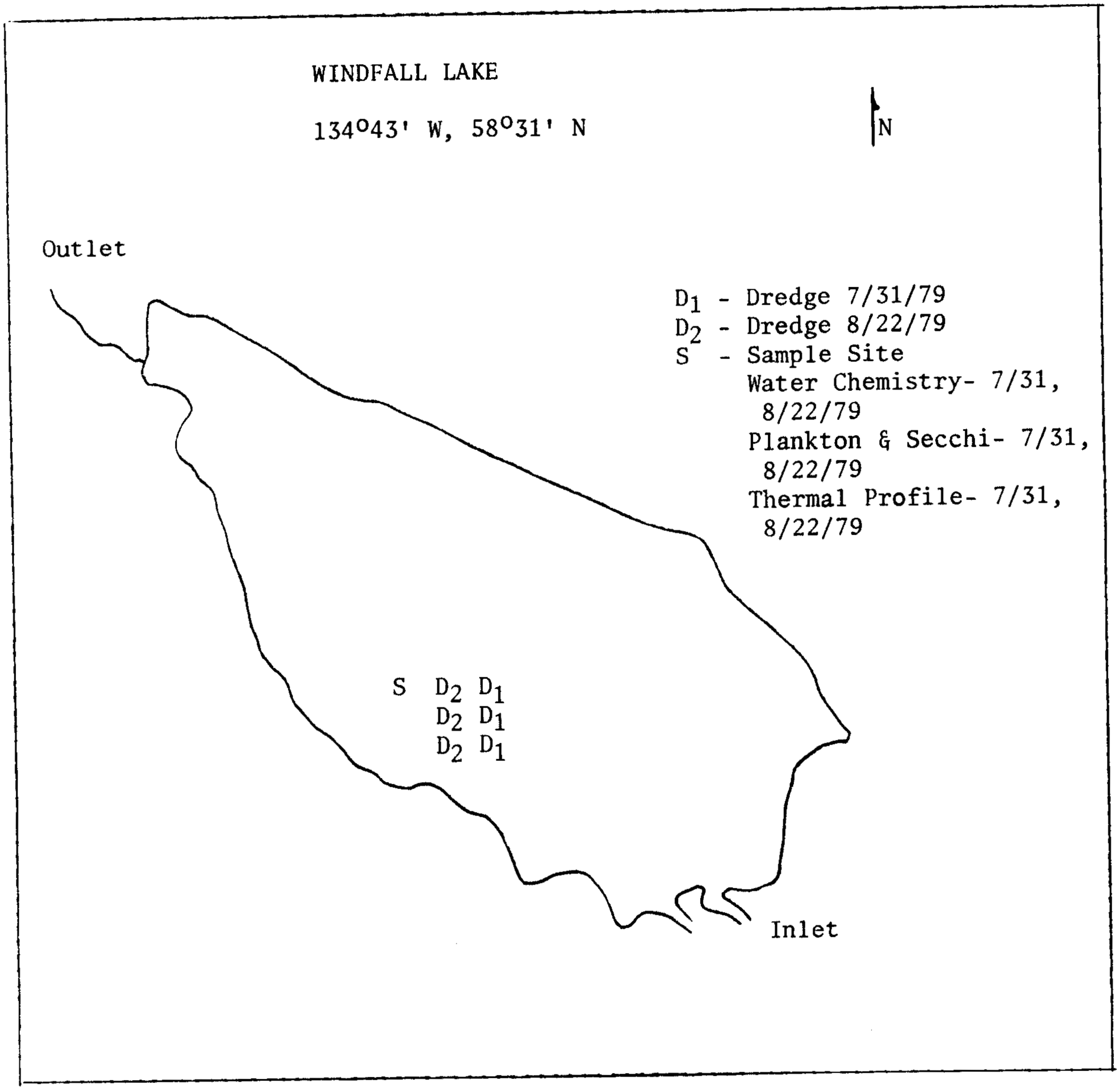

Fig. 21. Map showing location of sampling stations, Windfall Lake, 1979.

Table 7. Thermal data (°C) from lakes studied, 1979.

Depth (m)	Beaver Lake				Bessie Pond	Bridget Pond	Glacier Lake			
	June 1	July 19	Aug. 7	Aug. 30	Sept. 5	Sept. 5	June 13	July 10	Aug. 1	Aug. 24
S	10.0	14.9	15.8	16.5	13.8	14.9	15.5	17.0	17.0	19.0
1.0		14.8	15.6	17.0	13.8	14.0	15.2	18.0	17.2	18.8
2.0		14.6	15.5	16.8	13.8	14.0	15.0	17.0	17.1	18.8
3.0		14.6	14.8	16.8	13.5	9.9	13.0	16.2	17.0	18.2
4.0		13.0	14.4	15.2	10.2	7.0	10.0	15.4	14.9	16.0
5.0		10.0	12.5	12.5		5.3	7.5	15.0	13.5	
5.5							6.9		11.2	
6.0		8.5	10.0	10.5		4.8				
7.0		7.5	9.2	8.9		4.3				
8.0		7.0	8.0	7.5		4.2				
9.0		6.5	7.5	7.2		4.2				
10.0		6.0	7.0	6.8		4.1				
11.0		6.0	6.5	6.2		4.1				
12.0		6.0	6.2	6.2		4.1				
13.0		5.8	6.2	6.0		4.1				
14.0		5.5	6.0	6.0		4.1				
15.0		5.5	6.0	6.0						
16.0		5.4	5.9	5.9						
17.0		5.4	5.5	5.6						
18.0		5.3	5.2	5.5						
19.0		5.2	5.2	5.5						
20.0	8.0	5.0	5.0	5.5						
21.0			5.0	5.5						

Table 7. (Cont.) Thermal data (^{o}C) from lakes studied, 1979.

Depth (m)	Marshall Pond				Moraine Lake			Swan Lake (Sitka)				
	June 14	July 12	Aug. 2	Aug. 21	June 13	July 7	Aug. 20	May 31	July 3	July 20	Aug. 9	Aug. 29
S	15.0	20.0	16.5	18.2	14.5	18.0	19.0	12.5	15.9	15.5	17.5	19.8
1.0	15.0	19.0	16.5	18.2	14.7	18.0	18.8			15.5	15.6	19.5
2.0	15.0	17.8	16.5	18.0	14.0	17.2	18.0			13.5	13.0	16.0
3.0	11.5	16.0	16.8	17.5	13.5	17.0	18.0	12.0		12.5	12.2	11.2
4.0		15.0			12.0					12.0		
5.0	7.5	15.0	13.5									
5.5	6.9		11.2									
6.0												
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19.0												
20.0												
21.0												

Table 8. Secchi disc visibility (m) from lakes studied, 1979.

Date	Secchi Disc Visibility (m)	Date	Secchi Disc Visibility (m)
Airport Pond		Beaver Lake	
July 13	1.5	June 1	12.5
August 3	2.5	July 20	8.5
August 23	1.0	August 8	8.8
		August 28	9.5
Bridget Pond		Glacier Lake	
September 5	1.2	June 13	5.0
		July 16	4.8
Marshall Pond		August 6	5.0
		August 27	4.0
July 16	1.9		
August 2	2.0		
August 27	1.8	Moraine Lake	
		June 13	4.5 (bottom)
Swan (Sitka)		July 10	4.5
		July 30	4.5
May 31	3.0	August 20	4.5
July 3	2.6		
July 20	2.0		
August 9	1.5	Windfall Lake	
August 29	1.4		
		July 31	2.1
		August 22	2.2

Table 9. Partial water quality information for Airport, Bessie, Bridget, and Marshall Ponds, 1979.

Parameter	Airport Pond	Bessie Pond	Bridget Pond	Marshall Pond
pH		6.5	6.3	5.4
Hardness		51.0	51.0	2.0
Alkalinity		30.0	10.0	2.2
Conductivity	17,000			10.0

Table 10. Water quality analysis of lakes studied, 1979.

Parameter, Unit	Glacier Lake	Windfall Lake	Beaver Lake	Swan Lake (Sitka)
Specific Conductance, µmho	35.000	35.000	48.000	83.000
pH	6.700	6.700	6.700	6.800
Hardness, mg/l	14.000	15.000	15.000	29.000
Alkalinity, mg/l	14.400	13.200	12.800	24.000
Calcium, mg/l	3.633	2.120	2.969	3.016
Magnesium, mg/l	0.408	0.513	0.511	1.760
Sodium, mg/l	0.690	1.190	2.460	5.822
Potassium, mg/l	0.672	0.465	0.404	0.783
Iron, mg/l	0.174	1.349	0.016	2.633
Manganese, mg/l	0.016	0.059	0.006	0.085
Molybdenum, mg/l	0.060	0.040	0.060	0.020
Aluminum, mg/l	0.040	0.280	0.100	0.270
Boron, mg/l	0.100	0.160	<0.100	<0.100
Silica, mg/l	3.500	4.200	1.500	10.000
Fluoride, mg/l	<0.010	<0.010	<0.010	<0.010
Chloride, mg/l	<1.000	<1.000	<1.000	3.800
Sulfate, mg/l	3.000	9.750	5.250	13.500
Nitrate, mg/l	<0.100	<0.100	0.350	<0.100
Nitrite, mg/l	<0.010	0.010	<0.010	0.020
Ortho-Phosphate, mg/l	0.010	<0.010	<0.010	<0.010

Table 11. Plankton composition, density (organisms per square meter), and weight (milligrams per square meter) as collected with No.-153 Nitex plankton nets, Beaver Lake, 1979.

Date	June 1	June 22	July 20	August 8	August 28
Depth of Tow (m)	18.5	17.0	17.0	19.0	17.0
Copepoda					
Calanoida					
Diaptomus kenai and *D. franciscanus*	25,195	16,797	6,615	1,832	1,425
Nauplii	127	0	0	1,832	3,054
Cyclopoida	0	0	0	0	0
Nauplii	0	0	203	305	204
Cladocera					
Daphnia spp.	23,541	36,495	66,170	77,266	82,865
Bosmina longirostris	3,817	458	1,629	3,970	4,886
Holopedium gibberum	2,290	12,674	4,682	8,245	5,497
Rotifera					
Conochilus unicornis	254	27,486	47,642	160,029	6,108
Kellicottia longispina	509	7,177	22,600	54,667	131,322
Polyarthra sp.	0	0	0	0	204
Polyphemus pediculus	127	458	0	0	814
Dry Weight	444.4	347.1	378.7	368.5	262.1
Organic Weight	398.0	308.4	327.3	309.5	218.9
Ash Weight	46.4	38.7	51.4	59.0	43.2

Table 12. Plankton composition, density (organisms per square meter) and weight (milligrams per square meter) as collected with No.-153 Nitex plankton nets, Glacier Lake, 1979.

Date	June 13	July 10	August 1	August 24
Depth of Tow (m)	4.5	3.5	3.0	4.0
Copepoda				
Macrocyclops albidus and *M. fuscus*	1,080	458	3,156	1,578
Nauplii	0	509	1,018	356
Cladocera				
Daphnia longiremis	75,841	222,433	60,062	244,320
Bosmina longirostris	9,162	13,743	1,018	5,599
Alona costata	0	51	0	0
Rotifera				
Asplancha priodonta	9,851	4,072	4,886	47,846
Conochilus unicornis	764	0	11,198	3,054
Keratella sp.	0	1,527	102	0
Ploesoma hudoni	0	51	814	1,018
Polyarthra sp.	255	0	305	0
Dry Weight	178.2	328.3	197.5	266.7
Organic Weight	133.9	287.1	165.4	228.5
Ash Weight	44.3	41.2	32.1	38.2

Table 13. Plankton composition, density (organisms per square meter), and weight (milligrams per square meter) as collected with No.-153 Nitex plankton nets, Marshall Pond, 1979.

Date	July 12	August 2	August 21
Depth of Tow (m)	2.5	3.0	2.0
Copepoda			
Cyclopoida			
Macrocyclops albidus	2,341	204	0
Nauplii	0	305	0
Cladocera			
Bosmina longispina	204	0	0
Chydorus sphaericus	0	102	0
Ceriodaphnia lacustris	47,337	52,936	191,995
Daphnia longiremis	916	102	814
Holopedium gibberum	23,210	14,659	1,222
Polyphemus pediculus	305	102	204
Rotifera			
Conochilus unicornis	3,106,936	2,280,320	134,376
Keratella sp.	509	102	0
Polyarthra sp.	102	0	0
Dry Weight	449.3	331.9	252.0
Organic Weight	445.9	254.0	208.7
Ash Weight	53.4	77.9	43.3

Table 14. Plankton composition, density (organisms per square meter), and weight (milligrams per square meter) as collected with No.-153 Nitex plankton nets, Moraine Lake, 1979.

Date	June 13	July 10	July 30	August 20
Depth of Tow (m)	2.5	4.0	2.0	2.5
Copepoda				
Macrocyclops fuscus	3,767	2,036	3,054	2,036
Nauplii	0	1,222	3,970	0
Cladocera				
Bosmina longirostris	407	10,994	3,156	44,792
Daphnia longiremis	54,361	218,259	47,439	225,996
Rotifera				
Asplancha sp.	407	10,994	3,156	44,792
Conochilus unicornis	19,037	77,368	102,004	24,432
Ploesoma hudsoni	102	814	102	0
Dry Weight	248.4	239.2	89.6	286.1
Organic Weight	206.1	221.9	61.6	250.9
Ash Weight	42.2	17.3	28.0	35.1

Table 15. Plankton composition, density (organisms per square meter), and weight (milligrams per square meter) as collected with No.-153 Nitex plankton nets, Swan Lake, 1979.

Date	May 30	July 3	July 20	August 9	August 29
Depth of Tow (m)	2.5	3.0	2.0	2.0	2.0
Copepoda					
Cyclops vernalis	3,054	22,905	16,797	24,178	20,615
Nauplii	509	11,834	8,780	4,072	2,672
Cladocera					
Bosmina longirostris	53,954	44,283	37,030	17,561	38,939
Chydorus vernalis	0	0	382	0	382
Daphnia longiremis	285,549	195,074	69,479	114,525	242,793
Holopedium gibberum	255	0	0	0	0
Rotifera					
Conochilus unicornis	3,818	0	0	0	0
Filinia longiseta	0	382	0	0	0
Kellicottia longispina	0	382	1,527	0	0
Ploesoma truncatum	2,800	1,145	1,527	0	382
Polyarthra sp.	0	0	8,780	0	0
Synchaeta sp.	0	382	72,151	764	764
Dry Weight	574.2	281.5	343.1	282.0	442.3
Organic Weight	502.9	240.8	287.6	247.7	385.3
Ash Weight	71.3	40.7	55.5	34.6	57.0

Table 16. Plankton composition, density (organims per square meter), and weight (milligrams per square meter) as collected with No.-153 Nitex plankton nets, Airport Pond, Bessie Pond, Bridget Pond, and Windfall Lake, 1979.

Lake	Airport Pond			Bessie Pond	Bridget Pond	Windfall Lake	
Date	July 13	August 3	August 23	September 5	September 5	June 31	August 22
Depth	5.5	6.0	2.5	3.0	10.0	4.0	2.2
Copepoda							
Calanoida	6,592			129,184	2,265		
Nauplii	178			458			
Cyclopoida	713			27,181	18,044	377	0
Nauplii	178			4,276	13,921	188	0
Harpactacoida	2,316					0	509
Cladocera							
<u>Bosmina</u> sp.	178				13,998	357,074	13,641
<u>Ceriodaphnia</u> sp.	713					0	305
<u>Chydorus</u> sp.						0	102
<u>Daphnia</u> sp.	529					3,390	0
<u>Holopedium</u> sp.	178					188	0
Rotifera							
Bdelloid						188	0
<u>Asplancha</u> sp.						86,164	126,232
<u>Collotheca</u> sp.				153			
<u>Conochilus</u> sp.				458	14,252	1,206,819	164,916
<u>Kellicottia</u> sp.				1,222	942	377	0
<u>Keratella</u> sp.					2,647		
<u>Lindia</u> sp.	2,138						
<u>Monostyla</u> sp.						188	0
<u>Ploesoma</u> sp.					51		
Coelenterata							
Hydrozoa	23,694						
Dry Weight	218.9	348.3	343.1	641.8	87.0	294.7	70.8
Organic Weight	71.8	88.1	86.5	607.2	71.8	244.8	45.8
Ash Weight	147.1	296.2	256.4	34.6	15.3	49.9	25.0

Table 17. List of zooplankton species identified in Airport Pond, Bessie Pond, Bridget Pond, and Windfall Lake, 1979.

Airport Pond

Cyclopoid cop.
Cyclopoid nauplii
Harpacticoid cop.
Calanoid cop.
Calanoid nauplii
Ceriodaphnia
Holopedium
Daphnia
Bosmina
Lindia
Coelenterata (hydrozoa)
Ostracoda
Bivalve

Bridget Pond

Cyclopoid cop.
Cyclopoid nauplii
Calanoid cop.
Calanoid nauplii
Bosmina
Conochilus
Keratella
Kellicottia
Ploesoma
Water mite
Chaoborus larvae

Bessie Pond

Cyclopoid copepodid
Cyclopoid nauplii
Calanoid cop.
Conochilus
Collotheca
Kellicottia

Windfall Lake

Macrocyclops albidus
Harpacticoid copepods
Bosmina longirostris
Daphnia longiremis
Daphnia rosea
Sida crystallina
Holopedium gibberum
Ceriodaphnia laticaudata
Chydorus
Conochilus unicornis
Asplanchna (priodonta)
Kellicottia longispina
Monostyla
Bdelloidea
Spidermites
Ostracods
Chironomid larvae

Table 18. Enumeration of benthic organisms (number/m^2) from lakes studied, 1979.

Lake	Beaver	Glacier	Marshall	Moraine	Swan (Sitka)
Depth Range (m)	13.0-21.0	1.0-7.0	2.0-4.0	0.3-2.5	1.5-3.0
Number of Samples	11	12	9	13	9
Amphipoda	0	0	0	0	4.8
Chironomidae	19.6	642.3	798.9	404.1	406.6
Oligochaeta	23.5	179.4	660.2	245.1	162.6
Pelecypoda	0	186.6	0	178.8	138.7
Gastropoda	0	0	0	36.4	4.8

Table 19. Summary of fish sampling effort and catch data from lakes studied, 1979.

Date	Location	Gear Type	Total Hours Set	Catch
		Airport Pond		
8/23/79	Middle of Pond	Sinking Gill Net	6.50	6 SC; 2 PS (125-128 mm); 3 Flounders; 3 SS (170-200 mm)
8/23/79	Lower End of Pond	6 Fry Traps	18.75	11 SC
		Beaver Lake		
6/01/79	Outlet Stream	4 Fry Traps	1.25	0
7/17/79	By Inlet Stream	Sinking Gill Net	25.25	0
7/18/79	Upper End of Lake	Sinking Gill Net	19.50	0
7/18/79	In Shallows Around Shore	Rod and Reel	2.00	0
7/19/79	Lower End of Lake	Sinking Gill Net	23.25	4 GR (225-240 mm)
8/30/79	Lower End of Lake	Floating Gill Net	26.75	0
8/30/79	In Shallows Around Shore	Rod and Reel	2.00	0
9/18/79	Lower End of Lake	Floating Gill Net	19.00	6 GR (115-320 mm)
9/18/79	Lower End of Lake	Sinking Gill Net	19.00	2 GR (270-300 mm)
		Bessie Pond		
9/05/79	Lake Shore	6 Fry Traps	4.50	2 CT (150-175 mm); 18 DV (100-215 mm); 152 TST
9/05/79	Lower End of Lake	Sinking Gill Net	3.50	3 CT (215-245 mm); 1 DV (230 mm)
		Bridget Pond		
9/05/79	Lower End of Lake	Sinking Gill Net	3.50	0
9/05/79	Lake Shore	6 Fry Traps	3.75	19 TST

Table 19. (Cont.) Summary of fish sampling effort and catch data from lakes studied, 1979.

Date	Location	Gear Type	Total Hours Set	Catch
		Glacier Lake		
7/10/79	Lake Shore	6 Fry Traps	22.00	273 TST
7/11/79	Upper End of Lake	Sinking Gill Net	19.00	2 CT (380-430 mm); 1 SS (195 mm); 1 RT (570 mm)
8/02/79	By Outlet	Rod and Reel	1.00	2 SS (150 mm)
8/24/79	Lake Shore	6 Fry Traps	23.50	190 TST
		Marshall Pond		
7/12/79	Lake Shore	6 Fry Traps	11.75	0
7/12/79	Across Middle of Lake	Sinking Gill Net	4.00	1 SS (305 mm)
8/01/79	Along Shore	Rod and Reel	2.00	0
8/02/79	Along Shore	Rod and Reel	0.50	0
8/21/79	Across Middle of Lake	Sinking Gill Net	6.50	0
		Moraine Lake		
6/14/79	Middle of Lake	Sinking Gill Net	1.40	0
7/10/79	Lake Shore	6 Fry Traps	18.10	92 TST; 2 SS (140-144 mm)
7/12/79	Upper End of Lake	Sinking Gill Net	21.25	4 SS (145-255 mm)
8/02/79	By Inlet	Rod and Reel	1.00	2 SS (155 mm)
8/21/79	Lake Shore	6 Fry Traps	18.75	27 TST
		Swan Lake (Sitka)		
5/30/79	Inlet to Outlet	8 Fry Traps	26.00	131 TST; 5 DV (73-254 mm)
8/10/79	Inlet Stream, Wrinkleneck	6 Fry Traps	17.80	32 DV (55-205 mm); 1 RT (90 mm); 1 SC

Airport Pond, Juneau Area:

Limited investigations revealed Airport Pond to have high salinity water (17,000 micromhos) and depth of at least 5.5 m. No bathymetric map was prepared. The zooplankton samples taken reveal unstable populations. The first sample was comprised mainly of a marine hydrozoa. No plankton were present in either the second or third samples.

Fish species captured included two pink (125-128 mm) and three coho salmon (170-200 mm); flounder (not identified to species); prickly sculpin; and coastrange sculpin. Stomach contents of both the pink and coho salmon contained unidentifiable fish remains.

Fish evidently enter the pond during high tides when the flow gate is open. Float airplanes use the pond as a landing and parking area.

It is doubtful if the pond would support a significant population of rearing fish due to salinity extremes and unstable plankton populations. If fish were to be planted on a put-and-take basis, the flow gate would have to be modified to prevent fish emmigration. Aircraft landing and takeoff would preclude any boat use on the pond.

Beaver Lake, Sitka:

Limnological analysis of Beaver Lake near Sitka reveals a normal dimictic north-temperate lake. With maximum depth of 22 m, this lake stratifies thermally and undergoes two turnovers annually. Water is clear with Secchi disc visibility between 9 and 12 m. The average standing crop of net plankton is low (12.5 kg/ha).

Arctic grayling, the only fish in the lake, feed primarily on leeches, adult insects, and chironomid larvae and nymphs. Some age 0 Arctic grayling had fed exclusively on zooplankton, however. The age-length-weight relationship of Arctic grayling captured shows good growth (Table 20). Arctic grayling spawn in the outlet stream from Beaver Lake and often go over the outlet falls to their demise. The outlet weir structure should be rebuilt to prevent emmigration.

No other fish should be planted in the lake as Arctic grayling are utilizing the available food source, exhibit good growth rates, and are maintaining a fishable population.

Bessie Pond, Juneau:

Limited sampling information from Bessie Pond suggests it is one of the most productive shallow (4 m) waters in the Juneau area. Hardness (51 mg/l) and alkalinity (30 mg/l) are high for southeast Alaska. One zooplankton sample taken revealed a high copepod population.

Fish species resident to the lake include threespine stickleback, Dolly Varden, and cutthroat trout. Length-weight of cutthroat trout and Dolly Varden is shown in Table 21. Food of Dolly Varden included insects, clams, and bottom material, suggesting benthic feeding habits. The two cutthroat

Table 20. Age, sex, length, and weight of grayling from Beaver Lake, 1979.

Age	Sex	Length (mm)	Weight (g)
0	Male	140	34
0	Male	115	20
0	Male	145	51
0	Male	155	56
0	Male	130	28
1	Male	225	122
1	Female	220	123
1	Male	240	148
1	Female	240	146
1	Male	270	100
3	Female	300	300
3	Female	320	300
4	-	312	-

Table 21. Age, sex, length, and weight of cutthroat trout and Dolly Varden, Bessie Pond, 1979.

Age	Sex	Length	Weight
		Cutthroat Trout	
3	Female	215	112
3	Male	235	146
3	Female	245	156
		Dolly Varden	
2	Male	105	10
2	Unknown	105	16
3	Female	160	40
3	Female	165	52
4	Male	230	100
4	Male	215	100

trout sampled had both fed on fish, including threespine stickleback.

No management actions are recommended.

Bridget Pond, Juneau:

Bridget Pond is an acid (pH 5.7-6.4) lake deep enough to thermally stratify, which develops a complete oxygen deficiency near the bottom. Water is very brown with Secchi disc visibility of 1.2 m. Beaver activity is abundant. The only fish captured in the lake were threespine stickleback. No other species were captured in a gill net set for about 4 hours.

The only logical fish to plant in a lake with the above conditions would be cutthroat trout. The economics of such an introduction would have to be considered as the pond is quite remote.

Glacier and Moraine Lakes, Juneau:

Glacier and Moraine Lakes are small, interconnected lakes with nearly identical water chemistry, plankton, and benthos populations. These lakes are "normal" southeast Alaska waters with pH of 6.7, specific conductance of 35, alkalinity of 14.4, and very low dissolved nitrogen and phosphorus content.

Zooplankton populations in both lakes are low. The copepod population is quite low so prime food for planktonic feeders is scarce. The cladocera, Daphnia longiremis, is the most abundant zooplankton. Average standing crop of net plankton is very low even when compared with other southeast Alaska lakes. This is partially a function of limited depth.

Density of benthic organisms is normal, suggesting no unusual bottom conditions and no potential for greatly increased production even though the lakes are quite shallow.

Fish captured in these lakes include numerous threespine stickleback, coho salmon, and cutthroat and rainbow trout. Food habits of these fish (Table 22) show that the coho salmon fed primarily on insects but also ate whatever else was available. The two cutthroat trout stomachs contained threespine stickleback and unidentifiable fish remains. The one rainbow trout had eaten snails and dragonfly nymphs, indicating a benthic existence.

It is not reasonable to expect these lakes to support an intensive fishery without a put-and-take type fishery.

Development of a put-and-take fishery should include a fish species which would utilize the large threespine stickleback population. Stomach analyses suggests that cutthroat trout would be a good candidate. Coho salmon reared to about 200 mm could also be a candidate species. If possible, the lakes should be blocked or weired to prevent emmigration during high water periods.

Table 22. Age, sex, length, weight, and stomach contents of fish captured in Glacier and Moraine Lakes, 1979.

Age	Sex	Length (mm)	Weight (gm)	Stomach Contents
		Glacier Lake, Coho Salmon		
1	Male	150	40	37 Blackflies; 5 Yellow, Brown Insects
1	Male	150	38	78 Blackflies
2	Female	195	84	142 Assorted Insects; 1 Chironomid
		Glacier Lake, Cutthroat Trout		
5	Female	380	425	1 Unidentified Fish Remain; 5 Insect "Heads"
5	Male	430	600	9 Larvae-Type Organisms; Numerous Stickleback Bones; 1 Large Insect
		Glacier Lake, Rainbow Trout		
6	Female	570	1,600	28 Snails; 3 Dragonfly Nymphs
		Moraine Lake, Coho Salmon		
1	Female	155	48	2 Yellow Insects; 11 Clams; 1 Blackfly
2	Female	155	40	2 Oligochaetes; 93 Insects; 7 Small, Yellow Insects
2	Female	145	31	18 Small, Greenish Insects; 5 Chironomids
2	Unknown	144	28	11 Chironomids; 1 Small Caterpillar; 10 Black Insects
2	Male	255	162	7 Assorted Insects
3	Unknown	210	98	1 Seed; Unidentifiable Insects
4	Female	230	142	15 Large Dragonfly Nymphs

Marshall Pond:

Water of Marshall Pond is quite acidic (pH 5.4) and conductivity is low (10 micromhos). This pond had the highest population of chironomidae and oligochaetes of those studied. The only fish captured was a 6-year-old resident coho salmon (305 mm).

The pond isn't large enough to support a large fish population, and public access is not good. Consequently, a put-and-take fishery is not recommended. Catchable coho salmon would be a possibility.

Swan Lake, Sitka:

Specific conductance of Swan Lake (83 micromhos) is the second highest studied to date in Southeast Alaska. This is attributed largely to sodium and sulfate probably from domestic pollution. The pH is 6.8.

Swan Lake is known to have threespine stickleback, Dolly Varden, and introduced rainbow trout. The only test fishing involved fry trapping in the lake and main inlet, Wrinkleneck Creek. Eight traps along the lake shore caught 131 threespine stickleback and 5 Dolly Varden. Twelve fry traps in the inlet caught 119 Dolly Varden (50-205 mm) and 3 rainbow trout (90-120 mm). The presence of rearing rainbow trout demonstrates the creek's importance as a viable spawning and rearing area.

The only species which should be considered for introduction would be one which would feed on threespine stickleback.

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